

CODING FORMS FOR SRC INDEXING

Microfiche No.		OTS0001087	
New Doc ID	FYI-OTS-0794-1087	Old Doc ID	
Date Produced	06/25/87	Date Received	07/26/94
		TSCA Section	FYI
Submitting Organisation		DRY COLOR MFGS ASSN	
Contractor			
Document Title		INITIAL SUBMISSION: LETTER FROM DRY COLOR MFGS ASSN TO DYNAMAC CORP REGARDING C.I. YELLOW PIGMENT 53 WITH ATTACHMENTS, DATED 06/25/87	
Chemical Category		C.I. YELLOW PIGMENT 53	

DCMA



DRY COLOR MANUFACTURERS' ASSOCIATION

Representing the Color Pigments Industry

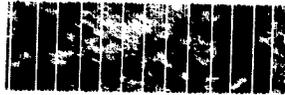
June 25, 1987

SUITE 202, 206 NORTH WASHINGTON STREET
ALEXANDRIA, VA 22314 (703) 634-4044

Mail: g Address:
P.O. BOX 20830, ALEXANDRIA, VA. 22320-1830

174
74I-0794-001087

Ms. Roberta Wedge
Staff Scientist
Dynamac Corporation
11140 Hockville Pike
Rockville, Maryland 20852



84946030174

No CB

JUL 26 PM 3:33

RECEIVED

Re: C.I. Yellow Pigment 53

Dear Ms. Wedge:

I am pleased to respond to your letter of May 2, 1986, requesting information with respect to C.I. Pigment Yellow 53. This response is being made on behalf of the Metal Oxides and Ceramic Colors Committee (the "Committee") of the Dry Color Manufacturers' Association (the "DCMA"). It is our understanding that your request was made in connection with your preparation of a revised Information Review on the compound, on behalf of the TSCA Interagency Testing Committee.

The Dry Color Manufacturers' Association is an industry trade association representing small, medium and large pigment color manufacturers throughout the United States and Canada, accounting for approximately 95% of the production of color pigments in this country. Foreign pigment manufacturers with sales in the United States and Canada and suppliers of intermediates to the pigments industry are also members of the Association. The Committee is composed of companies, both members and non-members of DCMA, with an interest in a class of inorganic pigments which includes C.I. Pigment Yellow 53.

In an attempt to respond to your inquiry, the Committee conducted a thorough survey of its membership requesting the types of information you specified in your letter of May 2, 1986. The time necessary to prepare such a survey, have it approved by the DCMA structure, obtain responses from Committee members, compile the responses and prepare this letter is far greater than the time necessary for individual companies to respond. However, this letter has the benefit of presenting the response of the bulk of the producers of the compound, and the information provided in this manner has no need to be declared confidential.

Enclosed is a copy of the questionnaire which was forwarded to members of the Committee. Ten responses were received, with seven companies providing information of significance in preparing this letter. We regard this as representing the entire United States based involvement with this compound. In this respect, we regard the information with respect to production, imports and worker exposure to be of greater reliability than that contained in the March 7, 1985 working draft of the Information Review. Our findings on these and other information requests made in your letter of May 2, 1986 are set forth below.

0003

For the five-year period from 1981 to 1985, inclusive, the combined total of production and imports yearly, reported to the DCMA, never exceeded 2.5 million pounds of C.I. Pigment Yellow 53. During this period, the proportion of pounds imported to total pounds has moved from approximately one-half to two-thirds. Moreover, the yearly production of C.I. Pigment Yellow 53 has never been more than 1,100,000 pounds during the period. It should be noted that there has been approximately a 4% average annual increase in total combined production and imports during the period, but that the total still remains below 2.5 million pounds of combined production and imports, yearly.

It is understood that the information contained in the draft Information Review, dated March 7, 1986, with respect to production, was derived from public sources, particularly the TSCA Inventory. We understand that the method of compilation of the TSCA Inventory information results in the availability of a broad bracket of possible production levels. From the information received by the DCMA, we believe that it is very safe to say that production and imports, combined, are below the lower limit set forth in the draft Information Review on page 2. It should be noted that the actual domestic production currently is approximately one million pounds, yearly.

Similarly, we believe that workplace exposure information contained in the draft Information Review may be high. The data provided to the DCMA indicates that the adjusted total of full person-year exposures in the domestic production of C.I. Pigment Yellow 53 is approximately ten people. Even allowing for significant multiplication of exposures downstream, we believe that the estimates in the draft Information Review could not result from the production, import and production-exposure data provided to the DCMA.

Information on personal, administrative and engineering controls shows that companies involved in production and imports currently engage in a number of protective activities designed to minimize the employee exposure to dust. It should be noted that the product is very stable and that any release would be as a dust. Protective procedures include the use in the workplace of NIOSH approved respirators for dusts and mists, protective goggles or safety glasses, safety uniforms and gloves, local exhaust or other means to minimize dust exposure, and, in some cases, end of shift on-site showers. This information generally coincides with the data set forth on pag 3 of the draft Information Review, reflecting details obtained from one company. The DCMA believes that this type of protection is standard in the industry, reflecting a general use of "state-of-the-art" equipment.

The information available with respect to concentration levels of workplace exposures to reactants used in production of C.I. Pigment Yellow 53 demonstrates that all such exposures are less than those recommended by the ACGIH as a voluntary standard in 1985, as set forth in the draft Information Review. However, it is difficult to be more precise than this with respect to specific exposures, since the data provided to DCMA by responding companies does not lend itself to compilation and generalization. However, it is safe to say that ACGIH limits are being met and that levels are being reduced over time.

We are very pleased to report that our survey has identified several unpublished studies, which are publicly available. Indeed, in some cases more than one responding company provided a copy of the same study. Enclosed are copies of the following:

- 1) February 14, 1963 study by Rosner-Hixson Laboratories for Sherwin-Williams Company, with respect to oral toxicity and eye and skin irritation.
- 2) March, 1972 study by the Department of Pharmacology of Tokyo Medical College, entitled "Pharmacological Studies of 'Titan Yellow' With Regards To Its Toxicity."
- 3) March, 1977 study by Duke Laboratories for Ferro Corporation, with respect to acute oral toxicity.
- 4) September 22, 1982 study done privately by CIBA-GEIGY Ltd., entitled "Acute Oral LD50 in the Rat."
- 5) December 22, 1982 study done privately by CIBA-GEIGY Lt., entitled "Acute Eye Irritation Study in the Rabbit."
- 6) December 22, 1982 study done privately by CIBA-GEIGY Ltd., entitled "Acute Skin Irritation Study in the Rabbit."

Further information can be obtained from the material safety data sheets of companies which participated in the DCMA survey. Representative examples of company MSDS's for C.I. Pigment Yellow 53 products are enclosed from the following seven companies:

- BASF Corporation
- CIBA-GEIGY Corporation
- Ferro Corporation
- Harshaw/Filtrol Partnership
- Mobay Chemical Corporation
- SCM Corporation
- The Shepherd Color Company

We greatly appreciate the opportunity which you have provided to the DCMA to compile and submit this information on a voluntary basis. We trust that this information will prove helpful in preparation of a revised Information Review, which we would appreciate receiving when it becomes available.

Very truly yours,



J. Lawrence Robinson
Executive Vice President

adt

Enclosures

Please submit this information in confidentiality

to:

Harold F. Fitzpatrick, Esq.
Fitzpatrick & Izzels
90 West 40th Street
P.O. Box 1227
Bayonne, New Jersey 07002

By: _____

(Signature)

Title

Company

DRY COLOR MANUFACTURERS' ASSOCIATION
Representing the Color Pigments Industry

SUITE 202, 208 NORTH WASHINGTON STREET
ALEXANDRIA, VA 22314 (703) 684-4044
Mailing Address:
P.O. BOX 20838, ALEXANDRIA, VA 22320-1838

September 12, 1986

**TO: Members, Metal Oxides and Ceramic
Colors Committee - Return by October 1, 1986**

**SUBJECT: Information Survey with respect to
C.I. Pigment Yellow 53**

As determined by the Committee, the DCMA has undertaken to provide this survey to members of the Committee in order to obtain certain information with respect to the production of C.I. Pigment Yellow 53, most commonly known as nickel antimony titanate, (the "Subject Pigment"). The survey which follows is intended to provide the Committee with information which will permit us to prepare a response to Dynamac Corporation, a contractor compiling information on behalf of the United States TSCA Interagency Testing Committee.

The purpose of the compilation of this information is to respond to certain questions which Dynamac and the ITC must address in considering whether C.I. Pigment Yellow 53 should be listed for further study. Enclosed for your immediate reference is a copy of the most recent draft of the Information Review, dated March 7, 1986, prepared to reflect the information which Dynamac has accumulated. We are seeking additional information to supplement the information generated by Dynamac. Generally, the type of information we are seeking is as follows:

- Production , import and process data.
- Unpublished toxicity data.
- Published toxicity data not listed in March 7, 1986 Information Review by DYNAMAC.
- Occupational exposure data.
- Use information, including technical literature and material safety data sheets.
- Environmental data.

This questionnaire has been designed to provide a simple way to respond to our request. Two copies are being forwarded to each member of the Committee, so that one copy can be completed and returned. You will note that this completed questionnaire should be returned directly to Harold F. Fitzpatrick, Esq., DCMA General Counsel, who will compile all data. All individual responses will be held in strict confidence and will be destroyed after compilation. Confidential information will not be disclosed, even in compiled form, unless there are sufficient responses to permit the preparation of information which will screen individual information provided, Counsel will prepare a draft submission to Dynamac and the ITC for review by the Committee.

We would appreciate your participation in this survey. A response on or before October 1, 1986 would be extremely helpful. There is no obligation to participate, but failure to obtain sufficient responses will preclude the Committee from providing a meaningful response. Any questions or comments which you may have with respect to responses to the survey should be directed to Harold Fitzpatrick at (201) 339-4000.

ALL RESPONSES BELOW ARE INTENDED TO BE LIMITED TO INFORMATION WITH RESPECT TO C.I. PIGMENT YELLOW 53 (CAS No. 8007-18-9)

PLEASE INDICATE ANY DEVIATIONS FROM THIS IN THE COMMENTS SECTION AT THE END OF THIS SURVEY.

PRODUCTION

Please indicate the total amount of the Subject Pigment manufactured for sale or use for the following calendar years:

1981	_____	pounds
1982	_____	pounds
1983	_____	pounds
1984	_____	pounds
1985	_____	pounds

If there is any substantial deviation for 1986 to date, please describe _____

_____.

IMPORT DATA

Please provide the same information as for production above, with respect to imports for sale or use.

1981	_____	pounds
1982	_____	pounds
1983	_____	pounds
1984	_____	pounds
1985	_____	pounds

UNPUBLISHED TOXICITY DATA

Do you have any unpublished toxicity data? Yes.
 No.

If so, we would appreciate your providing it to the General Counsel in confidentiality. He will review it and determine if it can be legally compiled into the Committee submission. Individual company data will not be revealed or submitted.

PUBLISHED TOXICITY DATA

Please list below any published studies, reports, etc., of which you are aware that are not listed in the most recent draft of the Information Review, dated March 7, 1986, prepared to reflect the information which DYNAMAC has accumulated. For your reference, see enclosed copy of said Information Review.

OCCUPATIONAL EXPOSURE DATA

Again, information on individual company occupational exposure data will only be used for compilation. If you choose to respond, please indicate:

Number of workers exposed _____
(adjusted for partial exposures
to full man-year exposures)

Please provide any information you may have on concentration levels:

Please describe any personal, administrative and engineering controls used:

USE INFORMATION

The ITC is interested in obtaining copies of technical literature and material safety data sheets from each individual producer of the Subject Pigment. Ordinarily, this type of information is in the public domain, and companies have no concern with respect to confidentiality. However, because this information may be made available to the Federal Government for regulatory purposes, you should be guided accordingly before submitting any materials. Any technical information and material safety data sheets provided should be forwarded with the response to this questionnaire to the DCMA General Counsel. He will review the material submitted for compatibility with the submission and for aspects of competition or compatibility. Material which passes these tests will be submitted to the ITC.

Please list below any material which you are submitting and any restrictions which you may impose on their submission to ITC.

6. - 2011

ENVIRONMENTAL DATA

Please provide a narrative paragraph indicating information such as:

- fraction released to the environment
- route of environmental entry
- environmental reactions/degradation rates and concentrations
- ecotoxicity data

If you have no such information available, please so indicate:

**MATERIAL SAFETY
DATA SHEET**

BASF Corporation Chemicals Division
100 Cherry Hill Road, Parsippany, New Jersey 07054, (201) 263-3400
HHS: H1+ P0 R0

BASF

PRODUCT NUMBER: 892941 SICOTAN® Yellow K 1010

SECTION I - IDENTIFICATION

TRADE NAME: SICOTAN® Yellow K 1010

CHEMICAL NAME: Nickel Antimony Titanium Yellow Rutile

SYNONYMS: Mixture of Pigment
Yellow B3; C.I. 77788

FORMULA: (Ti,Ni,Sb)₂O₂

CHEMICAL FAMILY: Inorganic Pigment

MOL. WGT.: N/A

SECTION II - INGREDIENTS

COMPONENT	CAS NO.	%	PEL/TLV - SOURCE
Pigment	8007-18-8	100	Not established
Contains:			
Antimony		< 8	0.5 mg/m ³ compounds, as Sb OSHA, ACSIH, 1986
Nickel		< 3	1 mg/m ³ as Ni ACSIH, OSHA, 1986
This product is supplied in compliance with the reporting requirements of TSCA.			

SECTION III - PHYSICAL DATA

BOILING/MELTING POINT @760 mm Hg: N/A	pH: 6.0 (50 g/l water)
VAPOR PRESSURE mm Hg @20 C: N/A	
SPECIFIC GRAVITY OR BULK DENSITY: 4.5	
SOLUBILITY IN WATER: Insoluble	
APPEARANCE: Yellow Powder	ODOR: None
	INTENSITY: N/A

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD): N/A	AUTOIGNITION TEMP: N/A
FLAMMABILITY LIMITS IN AIR (% BY VOL)	LOWER: N/A
	UPPER: N/A
EXTINGUISHING MEDIUM	Use water fog, foam, CO ₂ or dry chemical extinguishing media.
SPECIAL FIREFIGHTING PROCEDURES	Firefighters should be equipped with self-contained breathing apparatus and turnout gear.
UNUSUAL FIRE AND EXPLOSION HAZARDS	N/A

CHENTREC 800-424-8900 201-263-3400 616-262-2351
THIS NUMBER IS AVAILABLE DAYS, NIGHTS, WEEKENDS, AND HOLIDAYS

PRODUCT NUMBER: 882841

SICOTAN® Yellow K 1010

SECTION V - HEALTH DATA

TOXICOLOGICAL TEST DATA:

SICOTAN® Yellow K 1010

Rat, Oral LD50
Rabbit, Skin
Rabbit, Eyes

RESULT:

>10000 mg/kg.
Non-irritating
Non-irritating

EFFECTS OF OVEREXPOSURE:

Contact with eyes and skin results in irritation.
Ingestion may result in gastric disturbances.
Inhalation of dust may irritate the respiratory tract.

Chronic inhalation overexposure to nickel compounds may result in bronchitis or lung fibrosis. Overexposure to nickel compounds has caused kidney, liver and thyroid effects in animals.

FIRST AID PROCEDURES:

Eyes--Flush eyes with flowing water for at least 15 minutes.
If irritation develops, consult a physician.
Skin--Wash affected skin areas thoroughly with soap and water.
Remove and launder contaminated clothing before reuse.
If irritation develops, consult a physician.
Ingestion--If swallowed, dilute with water and induce vomiting.
Get immediate medical attention.
Never give fluids or induce vomiting if victim is unconscious or having convulsions.
Inhalation--If inhaled, move to fresh air.
Aid in breathing, if necessary, and get medical attention.

SECTION VI - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N/A

CHEMICAL INCOMPATIBILITY: N/A

HAZARDOUS DECOMPOSITION PRODUCTS: N/A

HAZARDOUS POLYMERIZATION: Does not occur

CONDITIONS TO AVOID: N/A

CORROSIVE TO METAL: No

OXIDIZER: No

SECTION VII - SPECIAL PROTECTION

RESPIRATORY PROTECTION:

NIOSH/MSHA-approved dust respirator as necessary.

EYE PROTECTION: Goggles.

PROTECTIVE CLOTHING: Gloves, coveralls, apron and boots as necessary to prevent skin contact.

VENTILATION: Use local exhaust to control dusts.

OTHER: N/A

MARSHAW/FILTROL
MATERIAL SAFETY DATA SHEET

CODE: 341-702

PRODUCT NAME
METEOR Bright Yellow 8320

N-33-84-WP

DATE: 04/15/86

SECTION I -- IDENTIFICATION

SUPPLIER'S NAME Marshaw/Filtrol Partnership

EMERGENCY TELEPHONE 216/292-9200

ADDRESS 30100 Chagria Blvd.
Cleveland, Ohio 44124

CHEMICAL NAME Nickel Antimony
Titanium Yellow Rutile;
C.I. Pigment Yellow 53

CAS No. 8007-18-9

U.N. No. Not applicable

FORMULA C.I. 77788

D.O.T. CLASSIFICATION Not regulated

SECTION II -- HAZARDOUS INGREDIENTS OF MIXTURES

<u>Material or Component</u>	<u>%</u>	<u>Threshold Limit Value</u>
Not applicable		

SECTION III -- PHYSICAL DATA

BOILING POINT Not applicable

MELTING POINT Not applicable

SPECIFIC GRAVITY (H₂O=1) 4.6

VAPOR PRESSURE Not applicable

VAPOR DENSITY (Air=1) Not applicable

SOLUBILITY IN H₂O (% by Wt.) Insoluble

% VOLATILES BY VOLUME Not applicable

EVAPORATION RATE (Butyl Acetate=1)
Not applicable

APPEARANCE AND ODOR Fine yellow powder; odorless

SECTION IV -- FIRE AND EXPLOSION DATA

Not a fire or explosion hazard.

SECTION V -- HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

0.5 mg/m³ as Sb (TWA), 1 mg/m³ as Ni (TWA)(ACGIH,1985/86). These values may not be applicable as the constituents are homogeneously and ionically inter-diffused to form a crystalline matrix of rutile.

EFFECTS OF OVEREXPOSURE

Although industrial handling of this product has been good, the toxicological properties have not been fully investigated. Prolonged or repeated contact may cause irritation to eyes, skin or respiratory tract.

Chronic: The NTP and IARC list nickel and certain nickel compounds as causing respiratory cancer in animals and humans. The specific nickel compounds causing cancer in humans have not been identified. This product is not identified in the groups of nickel compounds thought to cause cancer in animals or humans.

EMERGENCY AND FIRST AID PROCEDURES

Eye and Skin contact: Immediately flush eyes with water to remove particles. Call a physician if irritation develops. Wash skin with soap and water.

Inhalation: Remove to fresh air. If breathing is difficult, give oxygen. Call a physician.

04-15

DATE: 04/15/86 SECTION VI -- REACTIVITY DATA CODE: 541-702

CONDITIONS CONTRIBUTING TO INSTABILITY None expected

INCOMPATIBILITY None expected

HAZARDOUS DECOMPOSITION PRODUCTS None expected

SECTION VII -- SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Contain spillage and scoop up or vacuum. Avoid dusting. Notification of the National Response Center (800/424-8802) may be required. Refer to EPA, DOT and applicable state and local regulations for current response information.

It is recommended that each user establish a spill prevention, control and countermeasure plan (SPCC). Such plan should include procedures applicable to proper storage, control and clean-up of spills, including reuse or disposal as appropriate (see waste disposal method, below).

WASTE DISPOSAL METHOD Federal, state and local disposal laws and regulations will determine the proper waste disposal procedure. All waste materials should be reviewed to determine the applicable hazards (testing may be necessary). Disposal requirements are dependent on the hazard classification and will vary by location and the type of disposal selected. Some waste material are amenable to recycle/reuse.

SECTION VIII -- PROTECTIVE EQUIPMENT

VENTILATION General; local exhaust ventilation as necessary to control dust.

PERSONAL PROTECTIVE EQUIPMENT

Chemical goggles.

Gloves

A NIOSH/MSHA approved respirator as necessary

SECTION IX -- SPECIAL PRECAUTIONS

Avoid breathing dust.

Use with adequate ventilation.

Keep container closed.

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Keep away from food and feed products.

SECTION X -- PERSONNEL SAMPLING PROCEDURE

For metallic components: Refer to NIOSH Manual of Analytical Methods, 3rd Edition, Volume 1, Method 7300.

Information presented herein has been compiled from sources considered to be dependable and is accurate and reliable to the best of our knowledge and belief but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgement.

DATE: 04/15/86

CODE: 541-702

PRODUCT: METEOR Bright Yellow 8320



GLASS DIVISION
FERRO CORPORATION
6100 EAST 86th STREET
P O BOX 8580
CLEVELAND, OHIO 44101
TELEPHONE (216) 641 8580
TELEX 88-0188

COLOR MATERIAL SAFETY DATA SHEET

SECTION I PRODUCT IDENTIFICATION

TRADE NAME AND SYNONYMS V-9400 Nickel Titanate Yellow	
CHEMICAL NAME AND SYNONYMS Nickel Antimony Titanium Yellow Rutile C.I. Pigment Yellow #53	
CHEMICAL FAMILY Inorganic Pigment	TSCA INVENTORY CAS # 8007-18-9
CHEMICAL FORMULA (Ti,Ni,Sb) ₂ O ₂	C.I. #77788

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	TLV ₃ mg/M ³	ESTABLISHED OSHA PEL (Units)
Antimony Compound as Sb	0.5	0.5/mg/M ³

This pigment is formed by high temperature calcination. Therefore, it does not necessarily have any of the properties of its component oxides or metals.

SECTION III PHYSICAL DATA

BOILING POINT Not Applicable	VAPOR PRESSURE Not Applicable
MELTING POINT Not Applicable	VAPOR DENSITY Not Applicable
SPECIFIC GRAVITY (H₂O=1) 4.6-4.8	EVAPORATION Not Applicable
SOLUBILITY IN WATER Negligible	VOLATILE Not Applicable
APPEARANCE AND ODOR Yellow Odorless Powder	

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT METHOD USED Not Applicable	EXTINGUISHING MEDIA Not Flammable	FLAMMABLE (EXPLOSIVE) LIMITS Not Applicable
SPECIAL FIRE FIGHTING PROCEDURES None Required		
UNUSUAL FIRE AND EXPLOSION HAZARDS None		

FERRO PRODUCT DESIGNAT. N V-9400 Nickel Titanate Yellow

SECTION V HEALTH HAZARD DATA

HEALTH HAZARD DATA		Oral rat LD50 greater than 10gm/Kg body wt. non-toxic.	
PRINCIPAL ROUTES OF ABSORPTION	Inhalation & Ingestion	SKIN AND EYE IRRITATION	As Nuisance Dust
RELEVANT SYMPTOMS OF EXPOSURE	Dust from product may cause irritation of the respiratory system, or Nausea or metallic taste in the mouth.		
EFFECTS OF CHRONIC EXPOSURE	Prolonged exposure to dust may lead to pulmonary problems.		
EMERGENCY AND FIRST AID PROCEDURES	Skin - wash off contamination with soap and water. Eyes - flush immediately with clean water and call ophthalmologist. Ingestion - for excessive ingestion drink water or milk. Call a physician.		

SECTION VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY	Stable	CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	Will Not Occur
INCOMPATIBILITY (Materials to Avoid)	None		
HAZARDOUS DECOMPOSITION PRODUCTS	None		

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Uncontaminated material may be scooped up for use. If contaminated, scoop or vacuum into a receptacle for disposal.
WASTE DISPOSAL METHOD	Use as landfill in accordance with local state, and federal regulation.

SECTION VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS	Suitable for dusts not more toxic than lead.	PROTECTIVE EQUIPMENT EYE	Protect against dust particles.
MECHANICAL (GENERAL)	Vent dust to collector.	GLOVES	Work gloves (cotton)
SPECIAL	None	RESPIRATOR	OSHA approved for dust.
OTHER PROTECTIVE EQUIPMENT	Wear appropriate, clean, protective clothing, such as, but not limited to coveralls, smocks, aprons, gloves, shoes and/or hats.		

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE	Protect containers against physical damage. Store in dry area away from feed and food products. Avoid making dust. Do not inhale dust. Do not ingest. Wash hands, forearms, face and neck before eating, drinking, smoking or applying cosmetics.		
Carcinogenicity:	NTP? NC	IARC Monographs?	NO
		OSHA Regulated?	NO

P. Palmer
 Signature _____ Date April 1986

"The information herein is given in good faith but no warranty, express or implied, is made."

DELAYED INJURY.

SIGNS AND SYMPTOMS OF EXPOSURE:

NONE KNOWN

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

NONE KNOWN.

EMERGENCY AND FIRST AID PROCEDURES-EYES:

IMMEDIATELY FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES.
CALL A PHYSICIAN.

EMERGENCY AND FIRST AID PROCEDURES-SKIN:

WASH WITH MILD SOAP AND WATER. CALL A PHYSICIAN.

EMERGENCY AND FIRST AID PROCEDURES-INGESTION:

IF CONSCIOUS, GIVE LARGE QUANTITIES OF WATER OR MILK.
INDUCE VOMITING. CALL A PHYSICIAN.

EMERGENCY AND FIRST AID PROCEDURES-INHALATION:

REMOVE TO FRESH AIR. CALL A PHYSICIAN.

SECTION VII-SPILL OR LEAK PROCEDURES

SPILL PROCEDURES:

SWEEP OR VACUUM AND PLACE INTO CLOSABLE CONTAINER FOR
DISPOSAL. WEAR PROTECTIVE EQUIPMENT SPECIFIED BELOW.

WASTE DISPOSAL METHODS:

DISPOSE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL
REGULATIONS.

SECTION VIII-SPECIAL PROTECTION INFORMATION

VENTILATION:

USE LOCAL EXHAUST.

PROTECTIVE GLOVES:

RECOMMENDED.

EYE PROTECTION:

PROTECT FROM DUST PARTICLES.

RESPIRATORY PROTECTION:

USE NIOSH APPROVED DUST MASK.

SECTION IX-SPECIAL PRECAUTIONS

HANDLING, SHIPPING AND STORING PRECAUTIONS:

IN ACCORDANCE WITH GOOD INDUSTRIAL PRACTICE, HANDLE WITH
CARE AND AVOID UNNECESSARY PERSONAL CONTACT.

WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING, DRINKING,
OR USING TOBACCO PRODUCTS.

USE WITH ADEQUATE, LOCALIZED VENTILATION.

WEAR NIOSH APPROVED DUST RESPIRATOR FOR POTENTIALLY DUSTY
HANDLING OPERATIONS.

FOR INDUSTRIAL USE ONLY.

PAGE 4

ISSUE DATE: 11/12/85 REVISION: 04
FOR FURTHER HEALTH/SAFETY INFORMATION, CONTACT : ALAN SCHENKEL
FOR TECHNICAL INFORMATION CONTACT YOUR TECHNICAL SALES REPRESENTATIVE.

THE INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BASED UPON
DATA BELIEVED TO BE CORRECT. HOWEVER, NO GUARANTEE OR WARRANTY OF ANY
KIND EXPRESSED OR IMPLIED IS MADE WITH RESPECT TO THE INFORMATION
CONTAINED HEREIN.

10401 YELLOW

M A T E R I A L S A F E T Y D A T A S H E E T

CIBA-GEIGY CORPORATION
PLASTICS & ADDITIVES DIVISION
THREE SKYLINE DRIVE
HAWTHORNE, NEW YORK 10532

EMERGENCY PHONE NUMBERS:
SAFETY/HEALTH: (914) 347-4700
AFTER HOURS : (800) 334-9481

SECTION I-IDENTITY INFORMATION

IDENTITY (TRADENAME): 10401 YELLOW

FAMILY/CHEMICAL NAME:
NICKEL ANTIMONY TITANIUM YELLOW RUTILE

PRODUCT TYPE:
INORGANIC PIGMENT

HAZARD STATEMENT :

* THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN *
* PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD *
* COMMUNICATION STANDARD 29 CFR 1910.1200. *
* THIS PRODUCT IS NOT CONSIDERED TO BE A HAZARDOUS *
* CHEMICAL UNDER THAT STANDARD. *

SECTION II-HAZARDOUS INGREDIENTS

SPECIFIC CHEMICAL NAME:

NOTE! ALTHOUGH THIS PRODUCT CONTAINS INGREDIENTS(S) LISTED BY OSHA AND/OR ACGIH, OUR HEALTH HAZARD EVALUATION CONCLUDED THAT, BASED ON THE NATURE OF THE PRODUCT AND DATA ON SIMILAR PRODUCTS, THE EXPECTED HAZARDS DO NOT EXIST. THIS PIGMENT BELONGS TO THE MIXED METAL OXIDE INORGANIC PIGMENT CLASS. PIGMENTS OF THIS CLASS ARE THE RESULT OF HIGH TEMPERATURE CALCINATION. ALTHOUGH THEY CONSIST OF METAL ATOMS AND OXYGEN ATOMS ARRANGED IN UNIQUE CRYSTAL STRUCTURES, THEIR TOXICOLOGICAL PROPERTIES ARE NOT CONSIDERED TO BE THOSE OF EITHER THE METAL OR THE METAL OXIDES. THEY ARE MAN-MADE MINERALS WHICH CLOSELY DUPLICATE THE PROPERTIES OF THEIR NATURAL COUNTERPARTS.

COMMON NAME: NICKEL, INSOLUBLE COMPOUNDS AS (NI)
OSHA PEL: NONE
ACGIH TLV: 1.0 MG NICKEL/CU. M. AIR TLV

COMMON NAME: ANTIMONY COMPOUNDS AS (SB)

10401 YELLOW

OSHA PEL: 0.5 MG ANTIMONY/CU. M. AIR TWA
ACGIH TLV: 0.5 MG ANTIMONY/CU. M. AIR TWA

SECTION III-PHYSICAL DATA

APPEARANCE AND ODOR:
YELLOW POWDER, ODORLESS
MELTING POINT:
NOT AVAILABLE
DECOMPOSITION TEMPERATURE:
NOT AVAILABLE
PERCENT VOLATILE:
-0-
SOLUBILITY IN WATER:
NEGLIGIBLE
SPECIFIC GRAVITY:
>1 (H₂O = 1)

SECTION IV-FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:
NON-FLAMMABLE
EXTINGUISHING MEDIA:
WATER.
FIRE FIGHTING PROCEDURES-SPECIAL:
NONE REQUIRED.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NO UNUSUAL HAZARDS.

SECTION V-REACTIVITY DATA

STABILITY:
STABLE
HAZARDOUS POLYMERIZATION:
WILL NOT OCCUR.

SECTION VI-HEALTH HAZARD DATA

PRIMARY ROUTES OF EXPOSURE:
INHALATION.
ORAL LD50:
NOT AVAILABLE
SKIN IRRITATION:
NOT AVAILABLE
EYE IRRITATION:
NOT AVAILABLE
INHALATION LC50:
NOT AVAILABLE
OVEREXPOSURE EFFECTS:
NONE KNOWN
HARMFUL IF INHALED OR SWALLOWED.
REPEATED AND PROLONGED INHALATION MAY CAUSE

PRODUCT NUMBER: 882241 SICOTAN- Yellow K 1010

SECTION VIII - ENVIRONMENTAL DATA

ENVIRONMENTAL TOXICITY DATA:

None available.

SPILL AND LEAK PROCEDURES:

Spills should be contained and placed in suitable containers for disposal.
This material is not regulated under RCRA or CERCLA ("Superfund").

HAZARDOUS SUBSTANCE SUPERFUND: No RQ (lbs):

WASTE DISPOSAL METHOD:

Incinerate or bury in a licensed facility.
Do not discharge into waterways or sewer systems without proper authority.

HAZARDOUS WASTE 40CFR261: No **HAZARDOUS WASTE NUMBER:**

CONTAINER DISPOSAL:

Dispose of in licensed facility.
Recommend crushing or other means to prevent unauthorized reuse.

SECTION IX - SHIPPING DATA

D.O.T. PROPER SHIPPING NAME (49CFR172.101-102)

None

HAZARDOUS SUBSTANCE (49CFR CERCLA LIST)

No

REPORTABLE QUANTITY (RQ) None

D.O.T. HAZARD CLASSIFICATION (CFR172.101-102)

PRIMARY
None

SECONDARY
None

D.O.T. LABELS REQUIRED (49CFR172.101-102)

None

D.O.T. PLACARDS REQUIRED (CFR172.504)

None

POISON CONSTITUENT (49CFR172.203(K))

None

BILL OF LADING DESCRIPTION
Pigments NDI Dry

CC NO. 818

UN/NA CODE None

DATE PREPARED: 1 / 18 / 87

UPDATED: 2 / 8 / 87

WHILE BASF CORPORATION BELIEVES THE DATA SET FORTH HEREIN ARE ACCURATE AS OF THE DATE HEREOF, BASF CORPORATION MAKES NO WARRANTY WITH RESPECT THERETO AND EXPRESSLY DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. SUCH DATA ARE OFFERED SOFLY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION.

SECTION X - PRODUCT LABEL

SICOTAN® Yellow K 1010

CAUTION:
CONTACT WITH EYES AND SKIN MAY RESULT IN IRRITATION.
INGESTION MAY RESULT IN GASTRIC DISTURBANCES.
INHALATION OF DUSTS MAY IRRITATE THE RESPIRATORY TRACT.
CHRONIC INHALATION OVEREXPOSURE TO NICKEL COMPOUNDS MAY RESULT IN BRONCHITIS AND LUNG FIBROSIS.

Use with local exhaust and NIOSH/MSHA-approved dust respirator as necessary. Wear gloves, coveralls, apron, goggles and boots as necessary to prevent skin contact.

FIRST AID:

- Eyes** - Flush eyes with flowing water at least 15 minutes. If irritation develops, consult a physician.
- Skin** - Wash affected areas thoroughly with soap and water. Remove and launder contaminated clothing before reuse. If irritation develops, consult a physician.
- Ingestion** - If swallowed, dilute with water and induce vomiting. Get immediate medical attention. Never give fluids or induce vomiting if victim is unconscious or having convulsions.
- Inhalation** - Move to fresh air. Aid in breathing, if necessary, and get medical attention.

IN CASE OF FIRE: Use water fog, foam, CO2 or dry chemical extinguishing media. Firefighters should be equipped with self-contained breathing apparatus and turnout gear.

EMPTY CONTAINERS: All labeled precautions must be observed when handling, storing and transporting empty containers due to product residues. Do not reuse this container unless it is professionally cleaned and reconditioned.

DISPOSAL: Spilled material, unused contents and empty containers must be disposed of in accordance with local, state and federal regulations. Refer to our Material Safety Data Sheet for specific disposal instructions.

IN CASE OF CHEMICAL EMERGENCY: Call CHEMTREC day or night for assistance and information concerning spilled material, fires, exposure and other chemical accidents. 800-424-9300

ATTENTION: This product is sold solely for use by industrial institutions.

Refer to our Technical Bulletin and Material Safety Data Sheet regarding safety, usage, applications, hazards, procedures and disposal of this product. Consult your supervisor for additional information.

CAS No.: 8007-13-9.
Made in West Germany
Dyestuffs and Pigments
HSIS: H1+ FO RO
1286

MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME	SCM Pigments SCM Corporation	REGULAR TELEPHONE NO	(301) 355 3600
ADDRESS	3901 Glidden Road Baltimore Maryland 21226		
TRADE NAME	TITANIUM YELLOW TITANIUM GOLDEN		
SYNONYMS	Colour Index Pigment Yellow 53, C.I. 67778B DCMA Name: Nickel Antimony Titanium Yellow Rutile		
SHIPPING NAME	DOT:	Not Restricted Article	
	IATA:	Not Restricted Article	

II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS. NO.	%	HAZARD DATA
Titanium Dioxide	1317 80 2	80%	air contaminant
Antimony as insoluble rutile compound	8067 18 9	10.35 to 12.4%	air contaminant
Nickel as insoluble rutile compound	8067 18 9	2.75 to 3.0%	see Section IX

Titanium dioxide and antimony compounds are listed in OSHA Standards 29 CFR Section 1910.1000 Table Z-1 for air contaminants.
The question of carcinogenicity of certain nickel compounds (not including nickel rutile) is discussed in the NTP Report and ARC Monograph see Section IX of this MSDS.

III PHYSICAL DATA

BOILING POINT, 760 MM HG:	not known	MELTING POINT:	about 1700 °C
SPECIFIC GRAVITY (H₂O = 1)	4.1 to 4.4	VAPOR PRESSURE	Zero
VAPOR DENSITY (AIR = 1)	Zero	SOLUBILITY IN H₂O % BY WT:	insoluble
% VOLATILES BY VOL:	None	EVAPORATION RATE (BUTYLACETATE = 1):	Zero
APPEARANCE AND ODOR:	Fine, yellow-buff odorless powder	pH (AS IS)	
		pH (1% SOLN.):	5.5 to 8.5

IV FIRE AND EXPLOSION DATA

FLASH POINT: (TEST METHOD)	Not flammable	AUTOIGNITION TEMPERATURE:	Does not ignite
FLAMMABLE LIMITS IN AIR, % BY VOL.:		LOWER:	N A
		UPPER:	N A
EXTINGUISHING MEDIA:	No fire hazard.		
SPECIAL FIRE FIGHTING PROCEDURES:	None required.		
UNUSUAL FIRE AND EXPLOSION HAZARD:	None		

Y HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA	HAZARD CLASSIFICATION	BASIS FOR CLASSIFICATION	SOURCE
ROUTES OF EXPOSURE INHALATION	Substance: Particulate Dust Titanium Yellow Rutile, as pigment As TiO ₂ : TLV = 30 mg/m ³ or 10 mg/cu m OSHA Standard = 15 mg/cu m As Sb compound: TLV = 0.5 mg/cu m As insoluble Ni compound: No TLV established As Pigment: Equivalent TLV = 3 mg/cu m (estimated)	No Threshold Limit Values have been established for Nickel Antimony Human Experience	ACGIH (1984-5); 29 CFR 1910.1000 ACGIH (1984-5) & 29 CFR 1910.1000
SKIN CONTACT	Non-corrosive Non-irritating Non-sensitizing No erythema, no edema, and no other skin irritation in rabbits Rosner-Hixson Laboratories	Human Experience	16 CFR 1500.3 (b) (7), (8), & (9) 16 CFR 1500.41
SKIN ABSORPTION	Harmless Insolubility of nickel antimony titanium yellow rutile renders any skin absorption highly unlikely	Human Experience	16 CFR 1500.41
EYE CONTACT	Not particulate dust hazard only No sign of eye irritation in rabbits Report from Rosner-Hixson Laboratories (1963)	Human Experience	16 CFR 1500.41 16 CFR 1500.42
INGESTION	Non-toxic in animal feeding tests No toxic effect in rats, dogs, kittens, or fish. LD ₅₀ > 1 g/kg No signs of toxicity in rats. LD ₅₀ > 5 g/kg		Tokyo Medical College (1963) Rosner-Hixson Laboratories
EFFECTS OF OVEREXPOSURE			
ACUTE OVEREXPOSURE:	Temporary irritation to mucous membranes of nose and mouth may result from excessive dust conditions, and dust may restrict breathing.		
CHRONIC OVEREXPOSURE:	None known		
EMERGENCY AND FIRST AID PROCEDURES			
EYES:	Wash gently with water.		
SKIN:	Wash with water and mild soap.		
INHALATION:	Remove personnel from dust.		
INGESTION:	In case of excessive ingestion, drink a quart or more of water, followed by a glassful of milk, and call physician.		
NOTES TO PHYSICIAN:	The above emergency procedure for ingestion corresponds to that for acute antimony or arsenic poisoning in Gosselin, "Clinical Toxicology of Commercial Products," Fourth Edition (1976) Section III, page 41.		

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

Nickel Antimony Titanium Yellow Rutile is chemically inert and stable

INCOMPATIBILITY

This material may have slight solubility in strong acids

HAZARDOUS DECOMPOSITION PRODUCTS

None

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

None

VII DISPOSAL, SPILL OR LEAK PROCEDURES

AQUATIC TOXICITY (E.G. 96 HR TLM)

No changes in behavior, appearance, and no toxic effects were found in goldfish and daphnia at tested and in stirred aqueous suspensions of nickel antimony titanium yellow rutile containing up to 5% of the pigment.
Tokyo Medical College report 1963

WASTE DISPOSAL METHOD:

Nickel antimony rutile is not listed as a hazardous waste in EPA Regulations 40 CFR Section 261.30-35 and does not have the characteristic of EP toxicity. Otherwise, dispose of this material in accordance with EPA Regulations 40 CFR Parts 260-265 under the Resource Conservation and Recovery Act.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Use any feasible mechanical means to remove spilled material such as broom, brush, scoop, vacuum, or wet absorbent material, but avoid dusting during cleanup.

NEUTRALIZING CHEMICALS:

None required

VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS:

As required to remove and prevent dust

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT:

RESPIRATORY (SPECIFY IN DETAIL): Use NIOSH approved dust respirator

EYE: Safety glasses or goggles are suggested if dust is present

GLOVES: Optional. May be worn to protect skin if there is any drying effect from the dust

OTHER CLOTHING AND EQUIPMENT: None required

BEST COPY AVAILABLE

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Both the National Toxicology Program Third Annual Report on Carcinogens and the International Agency for Research on Cancer Monographs cite limited evidence for carcinogenicity to humans of certain nickel compounds, and sufficient evidence for carcinogenicity to animals. However, both state that it is not possible to specify which specific nickel compounds might be carcinogenic to humans. Nickel Antimony Titanium Yellow Rutile is not listed in the groups of compounds thought to be carcinogenic to either humans or animals.

OTHER HANDLING AND STORAGE REQUIREMENTS

Remove and prevent dust. Keep work area free of spills. Do not store in contact with foods. Avoid ingestion and wash hands before eating as a common sense measure.

HMS HAZARD RATINGS for Titanium Yellow and Titanium Golden

HEALTH HAZARD: 1
FLAMMABILITY HAZARD: 0
REACTIVITY HAZARD: 0
MAXIMUM PERSONAL PROTECTION: E

ADDITIONAL REGULATORY CONCERNS (FEDERAL, FDA, USDA, CPSC, STATE, OTHER)

None

TSCA: IS THIS PRODUCT, OR ALL ITS INGREDIENTS, BEING CERTIFIED FOR INCLUSION ON THE TOXIC SUBSTANCES CONTROL ACT INVENTORY OF CHEMICAL SUBSTANCES? Yes

January 1, 1985

PREPARED BY: David J. Heiser
TITLE: Technical Liaison
COMPANY: SCM Pigments, SCM Corporation
ADDRESS: 3901 Glidden Road, Baltimore, Maryland 21226



MATERIAL SAFETY DATA SHEET

The Shepherd Color Company

4539 Dues Drive P O Box 465627
Cincinnati, Ohio 45246
(513) 874-0714 Telex 24 1659

SECTION I PRODUCT IDENTIFICATION

PRODUCT NAME: Yellow No. 14 C.A.S. NUMBER: 8007-18-9 (71077-18-4*)
 CHEMICAL NAME: Nickel Antimony Titanium Yellow Rutile
 DATE PREPARED: 9/20/85 EMERGENCY TELEPHONE NUMBER: (513) 874-0714

SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS (SPECIFIC CHEMICAL IDENTITY; COMMON NAME)	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
Antimony & compounds (as Sb)	0.5mg/m ³	0.5mg/m ³	
Insoluble nickel compounds (as Ni) Note - There is no OSHA PEL or ACGIH TLV for insoluble nickel compounds. The PEL and the TLV for nickel metal is 1mg m ³ .			

This pigment is the result of high temperature calcination of the component substances. Due to its unique crystalline structure the properties of this finished pigment do not necessarily reflect the properties of the component metals or oxides.

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT: N.A. VAPOR PRESSURE (mmHg): N.A.
 SPECIFIC GRAVITY (H₂O=1) 4.4-4.8 VAPOR DENSITY (Air=1): N.A.
 MELTING POINT: N.A. EVAPORATION DATA: N.A.
 (Butyl Acetate=1)

SOLUBILITY IN WATER: Negligible
 APPEARANCE AND ODOR: Yellow powder - no odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used): N.A. FLAMMABLE LIMITS: LEL N.A. UEL N.A.
 EXTINGUISHING MEDIA: Water
 SPECIAL FIRE FIGHTING PROCEDURES: This product will not burn. Use appropriate techniques for fighting surrounding fire.
 UNUSUAL FIRE AND EXPLOSION HAZARDS: None

SECTION V HEALTH HAZARD DATA

ROUTES OF ENTRY: INHALATION X SKIN _____ INGESTION _____
 HEALTH HAZARDS: (ACUTE AND CHRONIC): May cause eye, skin and respiratory tract irritation. Acute oral toxicity - LD₅₀ > 10,000mg/kg oral-rat.⁵ Rabbit tests for primary skin irritant (not irritating; average score 0.5/6.0).⁶ Rabbit tests for eye irritants; no ulceration, corneal opacity or iris inflammation.⁶ Acute toxicity 90 days oral feeding and skin and eye irritation tests on rats have indicated no toxic symptoms.⁶ Some compounds of the metals contained in this pigment, antimony and insoluble nickel, have demonstrated various toxic properties.^{5,6,7} However, there is no evidence that this pigment has these toxic characteristics.
 CARCINOGENICITY: NTP No IARC MONOGRAPHS No OSHA REGULATED No

SIGNS AND SYMPTOMS OF EXPOSURE: Irritation of the eyes, skin and respiratory tract.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Respiratory and skin disorders aggravated by dust.

0030

SECTION V HEALTH HAZARD DATA (CONTINUED)

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

INGESTION: If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

SKIN CONTACT: Wash thoroughly with soap and water.

EYE CONTACT: Flush eyes with plenty of water for at least fifteen (15) minutes. Call a physician.

SECTION VI REACTIVITY DATA

STABILITY: STABLE X UNSTABLE: _____ CONDITIONS TO AVOID: N.A.

INCOMPATIBILITIES (MATERIALS TO AVOID): N.A.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: N.A.

HAZARDOUS POLYMERIZATION: WILL OCCUR _____ WILL NOT OCCUR: X CONDITIONS TO AVOID: N.A.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED OR RELEASED: Transfer material into closed containers for reuse or disposal. Maintain dust control.

WASTE DISPOSAL METHOD: Dispose of at an approved landfill, in accordance with local, state and federal regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store material in a closed container. Normal warehousing.

OTHER PRECAUTIONS: Good housekeeping procedures should be followed to prevent dust during processing.

SECTION VIII INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION: Use mechanical ventilation to keep dust below regulatory standards. See Section II.

RESPIRATORY PROTECTION: MSHA/NIOSH approved respirators for dust TC-21C.

PROTECTIVE GLOVES: Rubber, PVC Coated Gloves, impermeable.

EYE PROTECTION: Safety glasses with side shields, mono goggles.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Eye Wash Station.

WORK/HYGIENE PRACTICES: Do not eat, drink, or smoke in work areas. Wash thoroughly with soap and water after handling.

SECTION IX REFERENCES:

- 1). Occupational Diseases "A Guide to Their Recognition", U.S. DHEW (NIOSH), June, 1977.
- 2). Documentation of the Threshold Limit Values, 4th Edition, ACGIH, 1980.
- 3). Pocket Guide to Chemical Hazards, NIOSH/OSHA, Aug., 1981.
- 4). The Merck Index (10th Edition), 1983.
- 5). Acute Oral Toxicity Tests for Yellow 14, Shepherd Color Data, 8/2/79.
- 6). NPRI Raw Material Data Book, Vol. 4., pp. 24-25, National Printing Ink Research Institute.
- 7). Occupational Health Guidelines for Chemical Hazards, OSHA, Sept. 1978.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, The Shepherd Color Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will The Shepherd Color Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

VIII. REACTIVITY DATA

STABILITY.....: Stable
POLYMERIZATION.....: Will not occur
INCOMPATIBILITY
(MATERIALS TO AVOID)....: None known.
HAZARDOUS DECOMPOSITION
PRODUCTS.....: None known.

IX. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Don appropriate protective clothing. Vacuum or scoop up material and place in appropriately marked containers.

WASTE DISPOSAL METHOD: Material which cannot be recycled into your process should be landfilled in accordance with federal, state and local environmental regulations. Waste containing EP toxic metals should be tested to determine if it is a RCRA hazardous waste.

X. SPECIAL PRECAUTIONS & STORAGE DATA

STORAGE TEMPERATURE
(MIN./MAX.).....: Ambient/Ambient
SPECIAL SENSITIVITY
(HEAT, LIGHT, MOISTURE): None

PRECAUTIONS TO BE TAKEN
IN HANDLING AND STORING: Store away from food and drink. Wash hands before eating or smoking.

XI. SHIPPING DATA

TECHNICAL SHIPPING NAME...: Nickel Antimony Titanium Yellow Rutile
D.O.T. HAZARD CLASS.....: Non-Regulated
PKT. CLASS PKG......: Stains, NOI, Dry
PRODUCT LABEL.....: G.P. #100
REASON FOR ISSUE.....: Revision
APPROVED BY.....: Robert C. Campbell
TITLE.....: Regulatory Affairs Specialist
DATE APPROVED.....: 11-22-85



MATERIAL SAFETY DATA SHEET

DIVISION ADDRESS

Mobay Chemical Corporation
Inorganic Chemicals Division
Mobay Road
Pittsburgh, PA 15205-9741

ISSUE DATE 3/31/86
SUPERSEDES 12/21/81

TRANSPORTATION EMERGENCY: CALL CHEMTREC
TELEPHONE NO: 800-424-9300; DISTRICT OF COLUMBIA: 202-463-7816

MOBAY NON-TRANSPORTATION EMERGENCY NO.:
412/923-1800

I. PRODUCT IDENTIFICATION

PRODUCT NAME.....: BS-309
PRODUCT CODE NUMBER.....: OX74
CHEMICAL FAMILY.....: Mixed Phase Oxide
CHEMICAL NAME.....: Nickel Antimony Titanium Yellow Rutile
SYNONYMS.....: DCMA # 11-15-4; CI77788; CI Pigment Yellow 53
CAS NUMBER.....: 8007-18-9; 71077-18-4
T.S.C.A. STATUS.....: On Inventory
CHEMICAL FORMULA.....: (Ti, Ni, Sb) O₂

II. HAZARDOUS INGREDIENTS

The following potentially hazardous ingredients have been chemically reacted at high temperatures and are homogeneously and ionically interdiffused to form an essentially insoluble pigment crystal. This means that they are not present in the form of a simple physical mixture component.

COMPONENTS:

Antimony Compounds
Nickel (Insoluble Compounds)
Titanium Dioxide
Barium Compounds

CURRENT TLV:

0.5mg/m³ (as Sb)
1mg/m³ (as Ni)
10mg/m³
0.5mg/m³ (as Ba)

III. PHYSICAL DATA

APPEARANCE.....: Solid/Powder
COLOR.....: Yellow
ODOR.....: Odorless
MELT POINT.....: Greater than 2000°F
VAPOR PRESSURE.....: 0mmHg at 20°C
SOLUBILITY IN WATER.....: Essentially insoluble

IV. FIRE & EXPLOSION DATA

FLASH POINT °F(°C).....: Non Combustible
EXTINGUISHING MEDIA.....: No special requirements.
SPECIAL FIRE FIGHTING PROCEDURES/UNUSUAL FIRE OR EXPLOSION HAZARDS: None

Product Code: OX74
Page 1 of 3

V. HEALTH EFFECTS DATA

HUMAN EFFECTS

OF OVEREXPOSURE.....: Due to the abrasiveness of this product, mechanical irritation of the eye and skin can occur, particularly if contact is prolonged or repeated. Good personal hygiene and protective creams will minimize these effects. Exposure to the potentially hazardous components used to produce this product can occur if the dust is inhaled or ingested and the ingredients dissolve out of the pigment crystal. Because of the chemical stability of this type of pigment and its resistance to attack by acids or alkali, this is anticipated to occur very slowly. To date, adverse health effects from exposure have not been reported among workers using this pigment.

Overexposure to Antimony Oxide and other Antimony Compounds (primarily sulfides and halides) has been associated with eye and skin irritation. Animal inhalation studies using Antimony Oxide have failed to identify adverse effects on the lungs. However, studies of Antimony production workers show that lung changes are visible upon X-ray.

Nickel has been reported to produce a two primary effect as a result of acute and/or chronic exposures. A dermatitis ("nickel itch") has been reported in sensitive individuals having direct contact with alloys containing nickel. This dermatitis is felt to occur even in the general public as a result of handling or wearing Nickel or Nickel plated jewelry. The NTP has included "Nickel and certain Nickel Compounds" in its list of "Substances or groups of substances that may reasonably be anticipated to be carcinogenic". The IARC has placed "Nickel and certain Nickel Compounds in Group 2, Category A (Chemicals, groups of chemicals, industrial processes or occupational exposures probably carcinogenic to humans).

Barium Compounds, particularly in the readily soluble form are systemically toxic causing increased excitability of muscles. Cardiac, skeletal, intestinal and bronchial muscles are the sites of effect. Animal studies have shown exposure to barium can cause effects on the central nervous system. Oxides of barium are considered dermal and nasal irritants. Significant route of exposure are ingestion, inhalation and dermal contact.

Titanium Dioxide is a nuisance particulate. Nuisance particulates can cause unpleasant or uncomfortable deposits in the eyes, ears and nose, but do not cause any toxic effect or disease when exposures are kept in reasonable control.

THRESHOLD LIMIT VALUE.....: Not established for this product as a whole.

VI. EMERGENCY & FIRST AID PROCEDURES

EYE CONTACT.....: Flush eyes with water. Consult a physician if irritation develops.
SKIN CONTACT.....: Wash thoroughly with soap and water. Consult a physician.
INHALATION.....: Remove from the dusty area.

VII. EMPLOYEE PROTECTION RECOMMENDATIONS

EYE PROTECTION.....: Safety glasses or goggles
SKIN PROTECTION.....: Gloves are suggested to facilitate personal hygiene.
RESPIRATORY PROTECTION....: NIOSH approved for Dusts and Mists. Do not exceed the use limits of the respirator.
VENTILATION.....: Use local exhaust or other means to minimize worker exposure to airborne dust.

Product Code: OX74
Page 2 of 3

0034





Laboratory No. P163-10

CLIENT: Sherwin-Williams Company of Chicago, Illinois.

SAMPLE: A one pound sample of Solfast Titan Yellow, AURL 7536, was received in our laboratory on January 21, 1963.

OBJECT: To investigate (a) the oral toxicity and (b) the eye and skin irritation potential of the subject material in order to comply with the safety labeling requirements of the Federal Hazardous Substances Labeling Act.

EXPERIMENTAL & RESULTS:Single Oral Doses

The product was administered orally as a 20% aqueous suspension containing 0.2% Agar and 0.1% Tween 80 to ten male albino Sprague-Dawley strain rats weighing 190-245 grams at a dosage of 5.0 gm/kg. All the animals survived a dosage of 5.0 gm/kg and no signs of toxicity were noted. The animals were sacrificed at the conclusion of a fourteen day observation period, and no significant gross pathology was observed.

Primary Skin Irritation

The hair was clipped from the abdomen of six male albino rabbits, and two areas of the abdomen, approximately ten centimeters apart were designated for application of the patches. One, one-square inch site on the right side was abraded while a similar site on the left remained unbraded.

One-half gram of finely ground sample, moistened with saline, was placed on a small square of cotton gauze and maintained in contact with the skin under a larger square of polyethylene film and anchored to the skin with strips of adhesive tape. A square of flannel cloth was then taped around the trunk of the animal to further protect the patches from dislodged.

After 24 hours the vest and patches were removed and the skin examined for signs of irritation (erythema and/or edema). Examination was made again after 72 hours.

- Continued -

BEST COPY AVAILABLE

0035

The general technique of scoring was essentially that described by Draize, et al, Methods for the Study of Irritation and Toxicity of Substances Applied Topically to the Skin and Mucous Membranes. Journ. Pharm. and Exptl. Therap. 82, 377 (1944).

Upon removal of the patches there were no signs of erythema and/or edema. Further examination of the skin 72 hours following application of the patches indicated that the skin was normal in appearance and no signs of irritation were present.

Primary Eye Irritation

Approximately a 10 mg. quantity of finely ground product was introduced into the conjunctival sac of the right eye of each of six adult, albino rabbits. Lids were held closed for 30 seconds following the introduction of the dose, and the eye was examined immediately thereafter and at intervals over the next seven days. At these intervals the extent and degree of irritation were scored. The general technique of evaluation and scoring followed the recommendations of Draize, et al, Methods for the Study of Irritation and Toxicity of Substances Applied Topically to the Skin and Mucous Membranes. Journ. Pharm. and Exptl. Therap. 82, 377 (1944). The scores obtained are shown in Table 1.

CONCLUSION:

Sollast Titan Yellow AURL 7536 has an acute rat oral LD₅₀ of greater than 5.0 gm/kg and is therefore, considered to be a non-toxic material by ingestion in single oral doses. The product when introduced into rabbit eyes as a finely ground powder was found to be non-irritating. When the subject material was applied in 0.5 gm. quantities to intact and abraded skin of rabbits, no signs of irritation were noted. Therefore, the product is considered to be non-toxic, as well as non-irritating to the eye and skin within the definition of the Federal Hazardous Substances Labeling Act.

February 14, 1963

ROSNER-HIXSON LABORATORIES

Bob West

Bob West, Ph.D.
Assistant Director

RECEIVED

FEB 15 1963

MINERAL PRODUCTS
RESEARCH LABORATORY

0035

TABLE 1

SULFAST TITAN YELLOW ADRI. 7436

Rabbit Number	H585						H586						H587					
	1	24	48	72	96	168	1	24	48	72	96	168	1	24	48	72	96	168
Cornea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conjunctiva	2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0
TOTAL	2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0

Rabbit Number	H588						H612						H613					
	1	24	48	72	96	168	1	24	48	72	96	168	1	24	48	72	96	168
Cornea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conjunctiva	2	0	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0	0
TOTAL	2	0	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0	0

BEST COPY AVAILABLE



Duke Laboratories

TOXICOLOGY - CHEMISTRY - BIOCHEMISTRY - MICROBIOLOGY

8917 WEST CERMAK ROAD - NORTH RIVERSIDE, ILLINOIS 60546

March 14, 1977

FDA Registration No. 14-16917

Mr. Alfred McKinney
Ferro Corporation
4150 East 56th Street
Cleveland, Ohio 44105

SUBJECT: Examination of Ferro Corporation Inorganic Pigment Samples V-9400, V-9440, V-5200, V-9118, V-11633 and F-6331 for rat LD-50.

PROCEDURE: Sample Preparation: Twenty five grams of each sample was weighed into 25 ml volumetric flasks, distilled water was added, and the contents mixed thoroughly by shaking and stirring. More distilled water was added to bring the flask contents up to 25 ml volume. The contents of each flask was mixed thoroughly just before use.

Acute Oral Toxicity, Median Lethal Dose (LD-50): The samples were tested employing Sprague-Dawley female rats. The animals were deprived of food and water overnight and then fed the samples at 10 gm/kg body weight. (1).

Sample administration was made employing a stomach tube. After administration they were given food and water ad libitum.

All rats survived for at least two weeks after feeding.

RESULTS: Results are presented in Table 1.

INTERPRETATION AND CONCLUSION: The rat oral LD-50 test results show that test samples of inorganic pigment V-9400, V-9440, V-5200, V-9118, V-11633 and F-6331 are practically non-toxic or relatively harmless by the oral route and that the probable lethal dose for man by the oral route is one quart or more.

Reference:

(1). The Association of Food and Drug Officials of the United States, Appraisal of the Safety of Chemicals in Foods, Drugs and Cosmetics, Topeka, Kansas, 1965.

Very truly yours,

Phillip S. Duke

Phillip S. Duke, Ph.D.
Pres. and Director

Note:
V 9400 is C.I. Pigment yellow 53

PSD:mad

Testing

Consultation

Analysis

Development

Research



Table 1

Oral Rat LD-50

Ferro Corporation
Inorganic pigment samples
V-9400 - Yellow

Rat No.	Weight gm	Dosage gm/kg	Dosage ml	Result After Two Weeks
1	83	10	.83	Survived
2	92	10	.92	Survived
3	70	10	.70	Survived
4	68	10	.68	Survived
5	85	10	.85	Survived
7	80	10	.80	Survived
8	89	10	.89	Survived

V-9440 - Yellow

9	70	10	.70	Survived
10	67	10	.67	Survived
11	95	10	.95	Survived
12	90	10	.90	Survived
13	87	10	.87	Survived
14	79	10	.79	Survived
15	83	10	.83	Survived
16	92	10	.92	Survived

V-5200 - Blue

17	85	10	.85	Survived
18	89	10	.89	Survived
19	94	10	.94	Survived
20	70	10	.70	Survived
21	87	10	.87	Survived
22	90	10	.90	Survived
23	81	10	.81	Survived
24	79	10	.79	Survived

Table Ia

Oral Rat LD-50

Ferro Corporation
Inorganic Pigment Samples
V-11633 - Kelly Green

Rat No.	Weight gm	Dosage gm/kg	Dosage ml	Result After Two Weeks
25	139	10	1.4	Survived
26	116	10	1.2	Survived
27	85	10	.85	Survived
28	101	10	1.0	Survived
29	85	10	.85	Survived
30	89	10	.89	Survived
31	92	10	.92	Survived
32	83	10	.83	Survived

V-9118 - Bright Golden Yellow

33	121	10	1.2	Survived
34	92	10	.92	Survived
35	116	10	1.2	Survived
36	97	10	1.0	Survived
37	80	10	.80	Survived
38	91	10	.91	Survived
39	87	10	.87	Survived
40	84	10	.84	Survived

F-6331 - Black

41	100	10	1.0	Survived
42	128	10	1.3	Survived
43	<u>122</u>	10	1.2	Survived
44	81	10	.81	Survived
45	84	10	.84	Survived
46	90	10	.90	Survived
47	101	10	1.0	Survived
48	99	10	1.0	Survived

CIBA-GEIGY LTD.
BASEL / SWITZERLAND
G02 TOXICOLOGY

December 15, 1982

(1982c)

REPORT

TK 13005

ACUTE EYE IRRITATION STUDY IN THE RABBIT

GU PROJECT NO. 821125

Drakenfeld Yellow 10401

10401

12 05 01/05 / Seifert

11141

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	SUMMARY AND CONCLUSIONS.....	2
3	PERSONNEL.....	2
	Study Director:.....	2
	Technical Personnel:.....	2
4	MATERIALS AND METHODS.....	3
	4.1 Test Article.....	3
	Code No.....	3
	Batch No.....	3
	Stability.....	3
	Description.....	3
	Generic Name.....	3
	Content of Active Ingredient.....	3
	Test Article Received:.....	3
	4.2 Experimental Animals.....	3
	Rationale.....	3
	Species and Strain.....	3
	Source.....	3
	Initial Body Weight Range.....	4
	Number of Animal and Sex.....	4
	Individual Identification.....	4
	Husbandry.....	4
	Adaptation Period.....	4
	Diet.....	4
	4.3 Design.....	4
	Basis.....	4
	Application of the Substance.....	4
	4.4 Calculation of the Primary Eye Irritation Index	7
	4.5 Procedure.....	8
	Starting Date of the Experiment.....	8
	End Date of the Experiment.....	8
5	Results.....	8
6	Archives.....	8
	Final Report.....	8
	Copy of the Final Report.....	8
	Raw Data.....	8
7	Distribution.....	8
	Sponsor.....	8
	Archives.....	8

TABLE OF CONTENTS (cont'd)

8	Liste of Tables.....	8
	Rabbit Irritation Scores.....	8
	Table 2.....	9

0043

1. INTRODUCTION

At the request of the Plastics & Additives Division an acute study in rabbits was conducted. The purpose was to determine the eye irritating potency of TK 13005.

This report presents the results of the laboratory investigation as compiled by the undersigned.

Study Director

G. SEIFERT, T.C.G., Section Head

..... *G. Seifert*

date: *Dec. 15, 82*

11144

2. SUMMARY AND CONCLUSIONS

Under the conditions of the present experiment TK 13005 was found to cause no irritation when applied to the rabbit eye mucosa.

The calculated primary irritation index was :

0.0 in unrinsed eyes

0.1 in rinsed eyes

3. PERSONNEL

Study Director:

G. SEIFERT, T.C.G., Section Head

Technical Personnel:

E. Pankhauser
E. Schaer
S. Winter

The job descriptions and the summaries of training and professional experience for all personnel participating in this study are kept in the archives of the test facility.

0045

4. MATERIALS AND METHODS

4.1 Test Article

Code No

TK 13005

Batch No.

41635-121081

Stability

stable

Description

solid

Generic Name

not applicable

Content of Active Ingredient

data not available

Test Article Received:

21.07.82

4.2 Experimental Animals

Rationale

The albino rabbit has been selected for this test as being a standard species for the determination of an acute eye irritation.

Species and Strain

New Zealand White Rabbits checked for normal ophthalmic conditions.

Source

Kleintierfarm Madoerin AG, CH-4414
Fuellinsdorf

0045

GU Project No. 021125

Test Article: TK 13005

Initial Body Weight Range

2 - 3 kgs

Number of Animal and Sex

3 male / 3 female

Individual Identification

ear numbers

Husbandry

Animals were housed individually in metal cages.

The animal room was air conditioned: temperature $22 \pm 3^{\circ}$ C, relative humidity $55 \pm 15\%$; 12 hours light/day, approximately 15 air changes/h.

Adaptation Period

4 days

Diet

Rabbit food, NAFAG, No. 814 Tox, NAFAG AG, Gossau, SG (Switzerland), and water were provided ad libitum.

4.3 Design**Basis**

The procedure used is based, but not in every part identical with the Proposed Guidelines of the United States Environmental Protection Agency (EPA) Paragraph 163.81-5 "Primary eye irritation study", Federal Register, Vol. 43 No. 163 August 22, 1978.

Application of the Substance

The test material in an amount of 0.1 g was inserted in the conjunctival sac of the left eye of the rabbits and the lids were gently closed for 15 seconds. The right eye was not treated and served as an untreated control. In 3 of the 6 rabbits approximately 30

PROPERTY OF CIBA-GEIGY LIMITED
CONFIDENTIAL

MAY NOT BE USED, DIVULGED, OR PUBLISHED WITHOUT THE CONSENT OF
CIBA-GEIGY LIMITED

[] [] 4 []

seconds after the treatment the treated eye was flushed with 10 ml of sterile physiological saline.

The eye irritation was assessed with a slit-lamp at 24, 48, 72 hours and 4 and 7 days after treatment and was scored for each individual rabbit as outlined in table 1.

Score for eye irritation in rabbits (Table 1)

CORNEA

- A Opacity and degree of density (most dense area scored)
 - No opacity..... 0
 - Scattered or diffuse area, details of iris clearly visible..... 1
 - Easily discernible translucent areas, details of iris slightly obscured..... 2
 - Opalescent areas, no details of iris visible, size of pupil barely discernible..... 3
 - Opaque, iris invisible..... 4

- B Area of cornea involved
 - One quarter (or less) but not zero..... 1
 - Greater than one quarter, but less than half..... 2
 - Greater than half, but less than three quarters..... 3
 - Greater than three quarters, up to whole area..... 4

A x B x 5 Maximum possible score..... 80

IRIS

- A Values
 - Normal..... 0
 - Folds above normal, congestion, swelling, circumcornea injection (any or all of these or combination of any thereof) iris still reaction to light (sluggish reaction is positive)..... 1
 - No reaction to light, hemorrhage, gross destruction (any or all of these)..... 2

A x 5 Maximum possible score..... 10

0 0 4 9

CONJUNCTIVAE

- A Redness (refers to palpebral and bulbar conjunctiva excluding cornea and iris)**
- Vessels normal..... 0
 - Vessels definitely injected above normal..... 1
 - More diffuse, deeper crimson red, individual vessels not easily discernible..... 2
 - Diffuse beefy red..... 3
- B Chemosis**
- No swelling..... 0
 - Any swelling above normal (includes nictitating membrane)..... 1
 - Obvious swelling with partial eversion of lids..... 2
 - Swelling with lids about half closed..... 3
 - Swelling with lids about half closed to completely closed..... 4
- C Discharge**
- No discharge..... 0
 - Any amount different from normal (does not include small amounts observed in inner canthus of normal animals)..... 1
 - Discharge with moistening of the lids and hairs just adjacent to lids..... 2
 - Discharge with moistening of the lids and hairs, and considerable area around the eye..... 3
- (A + B + C) x 2 Maximum possible score..... 20

4.4 Calculation of the Primary Eye Irritation Index

The mean reaction scores for cornea, iris and conjunctiva observed after 1, 2, 3, 4 and 7 days were summed up and the sum divided by 5.

Index

0	= none
0.1 - 10.9	= minimal
11.0 - 25.9	= slight
26.0 - 55.9	= moderate
56.0 - 84.0	= marked
above 84.0	= extreme

0050

4.5 Procedure

Starting Date of the Experiment

29.11.82

End Date of the Experiment

06.12.82

5. RESULTS

The results of the primary eye irritation test are reported in tables 2-7.

TK 13005 was found to cause no irritation when applied to the rabbit eye mucosa.

6. ARCHIVES

Final Report

WST 454

Copy of the Final Report

WST 452

Raw Data

WST 454

7. DISTRIBUTION

Spreadsheets

Archives

8. LIST OF TABLES

Rabbit Irritation Scores

After 24 Hours - Page 10

After 48 Hours - Page 11

After 72 Hours - Page 12

After 04 Days - Page 13

After 07 Days - Page 14

PROPERTY OF CIBA-GEIGY LIMITED

CONFIDENTIAL

MAY NOT BE USED, DIVULGED, OR PUBLISHED WITHOUT THE CONSENT OF

CIBA-GEIGY LIMITED

0051

Table 2

TABLE 2 - CALCULATION OF THE PRIMARY EYE IRRITATION INDEX

TIME AFTER EXPOSURE	MEAN REACTION SCORE					
	UNRINSED EYES (A)			RINSED EYES (B)		
	CORNEA	IRIS	CONJUNC- TIVA	CORNEA	IRIS	CONJUNC- TIVA
24 HOURS	0.0	0.0	0.0	0.0	0.0	0.7
48 HOURS	0.0	0.0	0.0	0.0	0.0	0.0
72 HOURS	0.0	0.0	0.0	0.0	0.0	0.0
4 DAYS	0.0	0.0	0.0	0.0	0.0	0.0
7 DAYS	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	0.0	0.0	0.0	0.0	0.0	0.7
TOTAL	0.0			0.7		

PRIMARY IRRITATION INDEX IN UNRINSED EYES

$$A = 0.0 : 5 = 0.0$$

PRIMARY IRRITATION INDEX IN RINSED EYES

$$B = 0.7 : 5 = 0.1$$

0052

TABLE 3
 RABBIT EYE IRRITATION SCORES - AFTER 24 HOURS

EYE TREATMENT	UNRINSED			RINSED		
	ANIMAL NO					
	37	38	39	40	41	42
SEX	♂	♂	♂	♀	♀	♀

1. CORNEA

A OPACITY	0	0	0	0	0	0
B AREA INVOLVED	0	0	0	0	0	0
a+b+c (MAX. 80)	0	0	0	0	0	0
MEAN SCORE CORNEA	0.0			0.0		

2. IRIS

	0	0	0	0	0	0
B SCORES (MAX. 10)	0	0	0	0	0	0
MEAN SCORE IRIS	0.0			0.0		

3. CONJUNCTIVA

A REDNESS	0	0	0	0	1	0
B CHEMOSIS	0	0	0	0	0	0
C DISCHARGE	0	0	0	0	0	0
C1+B+C2 (MAX. 20)	0	0	0	0	1	0
MEAN SCORE CONJ.	0.0			0.2		
TOTAL REACTION SCORE	0	0	0	0	1	0
GROUP MEAN	0.0			0.2		

PH : *paleo, citron-gelb*
 Breeder : *Nadorin*
 GU 2.1 Tox.No.: *84/82*

Visum : *E. Tanklauer*
 Date : *6.12.82*
 Test Period: *29.11.82*
6.12.82

TABLE 3 (CONT'D)

RABBIT EYE IRRITATION SCORES - AFTER 48 HOURS

EYE TREATMENT	UNRINSED			RINSED		
	ANIMAL NO					
	37	38	39	40	41	42
SEX	♂	♂	♂	♀	♀	♀

1. CORNEA

A OPACITY	0	0	0	0	0	0
B AREA INVOLVED	0	0	0	0	0	0
C SCORES (MAX. 80)	0	0	0	0	0	0
MEAN SCORE CORNEA	0.0			0.0		

2. IRIS

	0	0	0	0	0	0
D SCORES (MAX. 10)	0	0	0	0	0	0
MEAN SCORE IRIS	0.0			0.0		

3. CONJUNCTIVA

A REDNESS	0	0	0	0	0	0
B CHEMOSIS	0	0	0	0	0	0
C DISCHARGE	0	0	0	0	0	0
E=A+B+C/2 (MAX. 20)	0	0	0	0	0	0
MEAN SCORE CONJ.	0.0			0.0		
TOTAL REACTION SCORE	0	0	0	0	0	0
GROUP MEAN	0.0			0.0		

0059

ACUTE EYE IRRITATION STUDY IN THE RABBIT
GU Project No. 82/1125 Test Article: 7K/13005

TABLE 3 (CONT'D)

RABBIT EYE IRRITATION SCORES - AFTER 72 HOURS

EYE TREATMENT	UNRINSED			RINSED		
	ANIMAL NO	SEX				
	37	♂	38	♂	39	♂
	40	♀	41	♀	42	♀

1. CORNEA

A OPACITY	0	0	0	0	0	0
B AREA INVOLVED	0	0	0	0	0	0
c=AxBx5 (MAX. 90)	0	0	0	0	0	0
MEAN SCORE CORNEA	0.0			0.0		

2. IRIS

	0	0	0	0	0	0
b=SCORES (MAX. 10)	0	0	0	0	0	0
MEAN SCORE IRIS	0.0			0.0		

3. CONJUNCTIVA

A REDNESS	0	0	0	0	0	0
B CHEDIOSIS	0	0	0	0	0	0
C DISCHARGE	0	0	0	0	0	0
c=A+B+Cx2 (MAX. 20)	0	0	0	0	0	0
MEAN SCORE CONJ.	0.0			0.0		
TOTAL REACTION SCORE	0	0	0	0	0	0
GROUP MEAN	0.0			0.0		

ACUTE EYE IRRITATION STUDY IN THE RABBIT
GU Project No. 82425 Test Article: TX-3005

TABLE 3 (CONT'D)

RABBIT EYE IRRITATION SCORES - AFTER 4 DAYS

EYE TREATMENT	UNRINSED			RINSED		
	ANIMAL NO	37	38	39	40	41
SEX	♂	♂	♂	♀	♀	♀

1. CORNEA

A OPACITY	0	0	0	0	0	0
B AREA INVOLVED	0	0	0	0	0	0
a=AxBx5 (MAX. 80)	0	0	0	0	0	0
MEAN SCORE CORNEA	0.0			0.0		

2. IRIS

	0	0	0	0	0	0
b=SCORES (MAX. 10)	0	0	0	0	0	0
MEAN SCORE IRIS	0.0			0.0		

3. CONJUNCTIVA

A REDNESS	0	0	0	0	0	0
B CHEMOSIS	0	0	0	0	0	0
C DISCHARGE	0	0	0	0	0	0
c=A+B+Cx2 (MAX. 20)	0	0	0	0	0	0
MEAN SCORE CONJ.	0.0			0.0		
TOTAL REACTION SCORE	0	0	0	0	0	0
GROUP MEAN	0.0			0.0		

TABLE 3 (CONT'D)

RABBIT EYE IRRITATION SCORES - AFTER 7 DAYS

EYE TREATMENT	UNRINSED			RINSED		
	ANIMAL NO	37	38	39	40	41
SEX	♂	♂	♂	♀	♀	♀

1. CORNEA

A OPACITY	0	0	0	0	0	0
B AREA INVOLVED	0	0	0	0	0	0
a-AxBx5 (MAX. 80)	0	0	0	0	0	0
MEAN SCORE CORNEA	0.0			0.0		

2. IRIS

	0	0	0	0	0	0
b-SCOREx5 (MAX. 10)	0	0	0	0	0	0
MEAN SCORE IRIS	0.0			0.0		

3. CONJUNCTIVA

A REDNESS	0	0	0	0	0	0
B CHEMOSIS	0	0	0	0	0	0
C DISCHARGE	0	0	0	0	0	0
c-A+B+Cx2 (MAX. 20)	0	0	0	0	0	0
MEAN SCORE CONJ.	0.0			0.0		
TOTAL REACTION SCORE	0	0	0	0	0	0
GROUP MEAN	0.0			0.0		

00557

CIBA-GEIGY LTD.
BASEL / SWITZERLAND
GU2 TOXICOLOGY

(19826)

RECEIVED

December 15, 1982

JAN 17 1983

P & A TOX
CENTER

REPORT

TK 13005

ACUTE SKIN IRRITATION STUDY IN THE RABBIT

GU PROJECT NO. 821126

Drakenfeld Yellow 10401

10401

12 05 03 / Seifert

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	SUMMARY AND CONCLUSIONS.....	2
3	PERSONNEL.....	2
	Study Director:.....	2
	Technical Personnel:.....	2
4	MATERIALS AND METHODS.....	3
4.1	Test Article.....	3
	Code No.....	3
	Batch No.....	3
	Stability.....	3
	Description.....	3
	Content of Active Ingredient.....	3
	Test Article Received:.....	3
4.2	Experimental Animals.....	3
	Rationale.....	3
	Species and Strain.....	3
	Source.....	3
	Number of Animals.....	3
	Initial Body Weight Range.....	4
	Individual Identification.....	4
	Husbandry.....	4
	Diet.....	4
4.3	Design.....	4
	Basis.....	4
	Application of the Substance.....	4
4.4	Procedure.....	6
	Starting Date of the Experiment.....	6
	End Date of the Experiment.....	6
5	Results.....	6
6	Archives.....	6
	Final Report.....	6
	Copy of the Final Report.....	6
	Raw Data.....	6
7	Distribution.....	6
	Sponsor.....	6
	Archives.....	6
8	Tables.....	7
	Table 1 - Primary Irritation Index.....	7
	Table 2.....	8

1. INTRODUCTION

At the request of the Plastics & Additives Division an acute study in rabbits was conducted. The purpose was to determine the skin irritating potency of TK 13005.

This report presents the results of the laboratory investigation as compiled by the undersigned.

Study Director

G. Seifert T.C.G.

G. Seifert
.....
date: *Dec. 15, 82*

2. SUMMARY AND CONCLUSIONS

Under the conditions of the present experiment TK 13005 was found to cause minimal irritation when applied to intact and excoriated rabbit skin.

The calculated primary irritation index was 0.3.

3. PERSONNEL

Study Director:

G. Seifert T.C.G.

Technical Personnel:

A. Buenzli
E. Fankhauser
E. Schaer

The job descriptions and the summaries of training and professional experience for all personnel participating in this study are filed in the archives of the test facility.

4. MATERIALS AND METHODS

4.1 Test Article

Code No

TK 13005

Batch No.

41635-121081

Stability

stable

Description

solid

Content of Active Ingredient

not determined

Test Article Received:

21.07.82

4.2 Experimental Animals

Rationale

The albino rabbit has been selected for this test as being a standard species for the determination of an acute skin irritation.

Species and Strain

New Zealand White Rabbits

Source

Kleintierfarm Madoerin AG, CH-4414
Puellinsdorf

Number of Animals

3 male / 3 female

Initial Body Weight Range

2 - 3 kgs

Individual Identification

ear numbers

Husbandry

Animals were housed individually in metal cages.

The animal room was air conditioned: temperature $22 \pm 3^{\circ}$ C, relative humidity $55 \pm 15\%$; 12 hours light/day, approximately 15 air changes/h.

Diet

Rabbit food, NAFAG, No. 814 Tox, NAFAG AG, Gossau, SG (Switzerland), and water were provided ad libitum.

4.3 Design

Basis

The procedure used is based, but not in every part identical with the Proposed Guidelines of the United States Environmental Protection Agency (EPA), Paragraph 163.81-5 "Primary dermal irritation study", Federal Register, Vol 43 No. 163, August 22, 1978.

Application of the Substance

24 hours before treatment the flanks of the rabbits were shaved with an electric clipper (approximately 6 sq.cm each) and immediately before treatment the shaven skin on one side was slightly scarified with the help of a "Schroepfschnaepper", Aesculap, Switzerland. Gauze patches soaked (or loaded) with 0.5 g of the test material were applied to the prepared abraded and intact skin.

The patches were covered with an impermeable material and were fastened to the body of the rabbit with adhesive

tape. The dressings were removed after 24 hours.

The skin reaction was assessed upon removal and during a subsequent observation period of 7 days on the basis of the following evaluation scheme.

SCORE FOR SKIN IRRITATION IN RABBITS

Erythema and eschar formation

No erythema.....	0
Very slight erythema (barely perceptible).....	1
Well defined erythema.....	2
Moderate to severe erythema.....	3
Severe erythema (best redness) to slight eschar formation (injuries in depth).....	4
Total possible erythema score	4

Edema formation

No edema.....	0
Very slight edema (barely perceptible).....	1
Slight edema (edges of area well defined by definite raising).....	2
Moderate edema (raised more than 1 mm).....	3
Severe edema (raised more than 1 mm and extending beyond area of exposure).....	4
Total possible edema score	4

0 0 6 4

4.4 Procedure

Starting Date of the Experiment

29.11.82

End Date of the Experiment

06.12.82

5. RESULTS

The results of the primary skin irritation test are reported in tables 1 and 2 .

TK 13005 was found to cause minimal irritation when applied to intact and abraded rabbit skin.

6. ARCHIVES

Final Report

WST 454

Copy of the Final Report

WST 452

Raw Data

WST 454

7. DISTRIBUTION

Sponsor

Archives

8. TABLES

Table 1 - Primary Irritation Index

CALCULATION OF THE PRIMARY SKIN IRRITATION INDEX (TABLE 1)

The scores read after 24 and 72 hours for erythema and edema for the intact as well for the abraded skin were summed up and divided by 4 (FBSLA paragraph 191.11)

MEAN REACTION SCORE				
TIME AFTER EXPOSURE HOURS	ERYTHEMA		EDEMA	
	INTACT SKIN	ABRADED SKIN	INTACT SKIN	ABRADED SKIN
24	0.3	0.3	0.3	0.3
72	0.0	0.0	0.0	0.0
TOTAL	0.3	+ 0.3	+ 0.3	+ 0.3 = 1.2

PRIMARY IRRITATION INDEX = 1.2 : 4 = 0.3

ASSESSMENT OF IRRITATION

no irritation.....	0
minimal.....	0.1-1.0
slight.....	1.1-2.0
moderate.....	2.1-4.0
marked.....	4.1-6.0
extreme.....	6.1-8.0

0 0 6 6

Table 2

EVALUATION OF THE SKIN REACTIONS

a = intact skin
 b = abraded skin

Test Nr.: 821126
 Substance: TK 13005

		After 24 hours						After 48 hours						After 72 hours					
Sex		♂			♀			♂			♀			♂			♀		
Animal No.		37	38	39	40	41	42	37	38	39	40	41	42	37	38	39	40	41	42
Erythema	a	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
	b	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Edema	a	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
	b	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Total	a	0	2	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
	b	0	2	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0
Mean	a	0.2			0.2			0.2			0.0			0.0			0.0		
	b	0.2			0.2			0.0			0.2			0.0			0.0		
Group mean	a	0.2						0.2						0.0					
	b	0.2						0.0						0.0					

		After 4 days						After 7 days						After 10 days					
Sex		♂			♀			♂			♀			♂			♀		
Animal No.		37	38	39	40	41	42	37	38	39	40	41	42	37	38	39	40	41	42
Erythema	a	0	0	0	0	0	0	0	0	0	0	0	0						
	b	0	0	0	0	0	0	0	0	0	0	0	0						
Edema	a	0	0	0	0	0	0	0	0	0	0	0	0						
	b	0	0	0	0	0	0	0	0	0	0	0	0						
Total	a	0	0	0	0	0	0	0	0	0	0	0	0						
	b	0	0	0	0	0	0	0	0	0	0	0	0						
Mean	a	0.0			0.0			0.0			0.0			0.0			0.0		
	b	0.0			0.0			0.0			0.0			0.0			0.0		
Group mean	a	0.0						0.0						0.0					
	b	0.0						0.0						0.0					

Study conducted from 12.11.82 to 6.12.82

PH-Wert: 7.2
 Zucht: Macchia
 Tox.Nr.: 81/82

Appl. site NECROSIS in animals
 SCAB FORMATION in animals
 EXTENDED ERYTHEMA in animals

Von: J. Fankhaeuser
 Date: 6.12.82

RECEIVED

CIBA-GEIGY LTD.
BASLE / SWITZERLAND
GU2 TOXICOLOGY

(1982a)

P & A TOX
CENTER
RECEIVED
September 22, 1982

LOT 12 1982
P & A TOX
CENTER

REPORT

TK 13005

ACUTE ORAL LD50 IN THE RAT

GU PROJECT NO. 821124

Drakenfeld Yellow 10401

/ al

0 0 6 8

1. **INTRODUCTION**

As requested by the Plastics & Additives Division, the present study, project no. 821124, was conducted to determine the acute oral toxicity of TK 13005 in albino rats.

This report presents the results of the laboratory investigation as compiled by the undersigned.

Study Director

Dr. phil. II G. Serasin

..... *G. Serasin...*
date: *September 23, 1982*

0059

2. SUMMARY AND CONCLUSIONS

Upon an acute oral administration and a 14 day post-treatment observation period, the following LD50 (with 95% confidence limits calculated, where possible) was determined for TK 13005.

LD50 in male rats:

>2500 mg/kg bw.

LD50 in female rats:

>2500 mg/kg bw.

LD50 in rats of both sexes:

>2500 mg/kg bw.

An actual LD50 could not be determined, as doses higher than 5000 mg/kg were not applicable.

Symptoms

No specific symptoms were seen.

Conclusions

According to the company standard TK 13005 has a slight acute toxicity when administered orally to the albino rat.

3. PERSONNEL

Study Director:

Dr. G. Sarasin

Technical personnel:

H. Haechler
E. Pagliaro

The job descriptions and the summaries of training and professional experience for all personnel participating in this study are archived in the test facility.

4. MATERIALS AND METHODS

4.1 Test Article

Code No

TK 13005

Batch No.

41635-121081

Stability

stable

Description:

solid

Test Article Received:

July 21, 1982

4.2 Experimental Animals

Rationale

The rat has been selected for this test as being a standard species for the determination of an acute oral LD50.

Species and Strain

Rat, Tif:RAIf(SFF), F3-crosses of RII 1/Tif x RII 2/Tif

Source

CIBA-GEIGY LTD. Tierfarm, 4334
Sisseln, Switzerland

Initial Body Weight Range

160-195 g

Initial Age

7-8 weeks

Individual Identification

by colour code using picric acid

Husbandry

The animals were kept under conventional laboratory conditions. They were caged in groups of 5 in Macrolon cages type 3 with standardized soft wood bedding (Societe Parisienne des sciures, Pantin).

The animal room was air conditioned: temperature $22 \pm 3^\circ \text{C}$, relative humidity $55 \pm 15\%$, 12 hours light/day, approximately 15 air changes/h.

Diet

Rat food, NAFAG No. 890, NAFAG AG, Gossau, SG (Switzerland), and water were provided ad libitum.

4.3 Design

Basis

OECD Guideline No. 401

Dose Levels

2500, 5000 mg/kg

Number of Animals Per Dose Level

5 males and 5 females

Total Number of Animals

19

Administration of the Test Article

one single dose, per os

4.4 Procedure

Date of Administration

August 26, 1982

Date of Completion

September 14, 1982

Vehicle

Distilled water containing 0.5% carboxymethylcellulose and 0.1% polysorbate 80 (prepared by Pharmaceutical Division, Ciba-Geigy Ltd.).

Volume (ml/kg body weight) applied

10;20

Pretreatment

The animals were allocated to the different dose groups by random selection.

Prior to dosing, the animals were fasted overnight.

Administration

oral, by gastric intubation (gavage)

Observation Period

14 days or until all symptoms have disappeared, whichever lasts longer

4.5 Observations and Records

Mortality

daily, a.m. and p.m. on working days

Signs and Symptoms

daily

Body weight

on days 1, 7, 14 and at death

Necropsies

Spontaneously dying animals were submitted to a gross necropsy as soon as possible; survivors at the end of the observation period.

4.6 Toxicity Rating According to the Company Standard

high acute toxicity	LD50 < 50 mg/kg
medium acute toxicity	LD50 50-500 mg/kg
slight acute toxicity	LD50 500-5000 mg/kg
practically no acute toxicity	LD50 > 5000 mg/kg

4.7 Statistical Analysis

From the body weights, the group means and their standard deviations were calculated.

Where feasible, the LD50 including the 95% confidence limit were computed by the logit method (J. Berkson, J. Am. Stat. Ass. 39. 357-65, 1944)

5. RESULTS

5.1 Rate of Deaths

See Table 1

5.2 Bodyweight Changes

See Table 2

5.3 Clinical Symptoms

See Table 3

The surviving animals recovered within 10-11 days.

5.4 Autopsies

No compound related gross organ changes were observed.

TABLE 1 RATE OF DEATHS

Dose mg/kg	Totals			Time of Death													
	in Grp.	Deaths No.	%	Hours Aft. Treat.				Days After Treatment									
				1	3	5	24	2	3	4	5	6	7	8	9	10	11
Males																	
2500	5	0	0														
5000	5	0	0														
Females																	
2500	5	0	0														
5000	4	1	25	1													

TABLE 2 BODY WEIGHTS AND STANDARD DEVIATIONS

dose mg/kg	males			females		
	day 1	day 7	day 14	day 1	day 7	day 14
2500	179/ 6.9	245/ 9.3	302/ 7.1	167/ 8.5	202/ 8.2	226/ 9.0
5000	183/ 7.9	255/11.5	305/17.1	168/ 8.1	207/ 5.0	220/ 0.6

TABLE 3 SIGNS AND SYMPTOMS

Observations	Exposure day:				Days of post-exposure period																
	hours				1	3	5	24	2	3	4	5	6	7	8	9	10	11	12	13	14
2500 mg/kg																					
dyspnea	xx	xx	xx	x	x	x	x	x	x	x	x	x	x	x							
leopthalmus	x	x	x	x	x	x	x	x	x	x	x	x									
ruffled fur	xx	x	x	x	x	x	x	x	x	x											
body position																					
- curved	x	x	x	x	x	x	x	x													
5000 mg/kg																					
sedation	x	x	x																		
dyspnea	xx	xx	xx	xx	xx	xx	x	x	x	x	x	x	x								
leopthalmus	x	x	x	x	x	x	x	x	x	x	x										
ruffled fur	xx	xx	xx	x	x	x	x	x													
body position																					
- curved	x	x	x	x	x	x	x	x													

0076

6. ARCHIVES

Final Report

WST 454

Copy of the Final Report

WST 452

Raw Data

WST 454

7. DISTRIBUTION

Sponsor

Archives

PHARMACOLOGICAL STUDIES OF
"TITANI YELLOW"
WITH REGARDS TO ITS TOXICITY

by

Saburo Hara, Takoshi Shibuya, Ken Tokizaki,
Keido Yakazu, Tatsunori Kobayashi,
and Ryoji Takahashi.

Department of Pharmacology, Tokyo Medical College.

Translated from the Japanese
by

Terng T. Su, Ph.D.

March, 1972



THE FRANKLIN INSTITUTE RESEARCH LABORATORIES
SCIENCE INFORMATION SERVICES DEPARTMENT

1 0 6 9

PHARMACOLOGICAL STUDIES OF "TITANI YELLOW" WITH REGARDS TO ITS TOXICITY

1. INTRODUCTION

In recent years, various kinds of paints, especially pigments, have been developed. However, among the organic pigments, such as Hansa yellow and bentizin yellow, and inorganic pigments, such as yellow lead and cadmium yellow, that are chiefly used as yellow pigment, there is no one which excels in thermal-resistance, chemical-resistance, and weather-resistance. The appearance of an excellent category of yellow pigment has long been expected.

"Titani yellow" has been prepared to meet the above requirements. It is considered to be able to overcome the defects of previous yellow pigment, and can be used in a broad range of paints, printing inks and coloring agents for synthetic resins due to its capability of displaying desirable color tones. Other uses considered for this pigment are printing and coloring of packing-papers and cases for food and coating of food containers and toys.

Titani yellow was prepared by heating titanium oxide and small amounts of nickel oxide, antimony oxide and other additives at 1000°C; it is one of the yellow pigments belonging to the $TiO_2-NiO-Sb_2O_3$ compound. The mechanism of its coupling has not been clarified. The crystal exists as a rutile type which is the same as TiO_2 and it is predicted that, in the TiO_2 crystals, nickels and antimonys have substituted for the titanium and formed a solid solution. It has been demonstrated^{1,2,3} that this pigment is chemically extremely stable as titanium oxide crystal and shows resistance to all kinds of acids, alkalis, oxidants, and reducing agents.

Titanium, which is the basic material and is believed to be the chief constituent of this pigment, is one of the rare elements and belongs to the IV group in the IV period in Mendelejeff's periodical tabl. It has an atomic number of 22, atomic weight of 47.90, and can

have an atomic valence of 2, 3 and 4, similar to the element of silicon. It was first extracted from iron sand as titanium ore by Gregol in 1789, named by Kropoth as "Titan" and considered to be an important element, as rare as zirconium.

Pick⁴ had studied the properties of titanium sulfate, tannate and salicylate and found that titanium is harmless to animals and even had therapeutic effect on strumosis, conjunctivitis and lupus. Richet⁵ had reported that it had no effect on human nutrition, and Carozzi⁶ had concluded that titanium was harmless, based on the fact that titanium oxide was chemically inactive. Marui⁷ had studied the pharmacology, especially in the comparisons of titanium with zirconium and thorium using titanium succinate as example. Lendel⁸ had also reported the pharmacology of the succinate and Deriberi⁹ had studied the poisoning of titanium. However, these studies were not systematic, as were those which have been done in this laboratory.

For some time, both the pharmacological and the toxic actions of rare elements have been studied in this laboratory. Among those studies, Hara^{10, 11} reported the pharmacological actions of titanium and zirconium in 1923 and 1925, and Tsubata^{12, 13} reported the pharmacological and toxic actions using titanium oxalate and zirconium oxalate. It was demonstrated that these water-soluble compounds dissolved and released titanium ion when added to water and showed ion action, which is a characteristic of metals.

Since a substance such as titanium oxide, which is insoluble in water, shows no ion action and, therefore, is harmless, it is understandable that the substance is considered an inactive compound. However, as a small amount of antimony is a contaminant, it is necessary to have sufficient studies on its toxic action while it is being used as coating agent or coloring agent for foods.

This paper describes its research, using the methods from our previous studies on toxicities, especially the animal growth curves which are closely related to experimental findings of acute and chronic toxicity, together with blood tests, measurements of the weight and

volume of organs, and histopathological studies, which was carried out in order to obtain data on the application of titani yellow to the food industry.

II. MATERIALS AND EXPERIMENTAL SUBJECTS

The titani yellow was provided by Ishihara Sangyo K.K. A good reproducibility of analysis was difficult to obtain because of its high chemical stability. One example of the analysis is shown in the following:

TiO ₂	82.5%
NiO	1.7%
Sb ₂ O ₃	8.5%
residue	

The substance is yellowish, fine-grained, odorless powder. The animals used in the experiments were olizia latipes, goldfish, a male rat of the Wister type, a kitten and a dog. The germination and growth of pleum pratense were also studied.

The experimental methods are described and the results of individual experiments are shown under heading III.

III. EXPERIMENTAL RESULTS

(A) Studies on the toxic action of titani yellow on rats:

When the chemical being studied for toxicity is administered orally to a rat, especially when the toxic action is expected to be very small, it is very important that the experiment be performed with the growth curve as the standard and that general conditions be scrupulously observed. In order to obtain the most suitable growth curve, a healthy animal which had reached a certain degree of growth was desirable. Therefore, several times more male rats of the Wister type than would be needed were raised in a constant temperature in the laboratory and were observed for two weeks; the rats in generally good condition were used in the experiments.

The animals were raised in an animal house having a Hitachi RP 500 air-conditioner with constant temperature and humidity equipment of the circulatory type. The temperature was kept at $22 \pm 1^{\circ}\text{C}$. The rats were divided into 8 groups, in which 4 were control groups. There were 10 rats in a group and each rat was kept in a separate cage. Their food consisted of powder feed M and solid feed MF from Oriental Yeast Industry K.K., and three drops of vitamin complex were added in the drinking water. Certain amounts of fresh vegetables were also fed once a week.

In order to have the titani yellow, the test chemical, administered in certain amounts, it was given in three feed groups: namely, 1% contamination, 5% contamination, and 10% contamination. These were orally administered at a given time daily for 90 days.

Referring to the experimental results¹¹⁻²⁴ that were obtained in this laboratory on the growth rate and the amounts fed and actually consumed, control feeding was used in order to prevent the animals from overeating. It was also the best method of dosage to provide precise results when the growth of the rat was considered. Therefore, this method of feeding was used throughout the experiments.

The feed dosage containing the testing compound was as follows: The dose for the first month was considered as 1. The dose for the second month was 2 times and for the third month was 2.5 times of that of the first month. That is, in accordance with the growth of the rats, 10g of the feed containing titani yellow was fed to each rat for the first month, 20g for the next month and 25g for the third month. Supplemental feed without the test chemical were also given. In the first month, about 5g of the usual feed was taken by each of most of the rats, besides the regular doses of feeds containing the test sample. In the third month, some of the regular feeds were left untouched by many of the rats. Therefore, the daily dosage for the group given feed containing 1% of titani yellow was about 100 mg/kg.; about 500 mg/kg. for the group given feed containing 5% of titani yellow; and about 1000 mg/kg. for the group given feed containing 10% of titani yellow.

Since the testing compound titani yellow is not soluble in water, it was mixed thoroughly with the powder feed M to make small pellets and the growth experiments were performed after it was ascertained that the animals would take the feed without hesitation. A solid feed prepared by solidifying the powder feed M was also used as solid feed MF containing no titani yellow. The determination of the dosage was based on the consideration that a maximum of 10% contamination exists in the coated ink (several microns of thickness) when used as the coloring agent in printing and coloring inks for packing-papers and containers for foods, or about 10% contamination in the coated film when it is used as coloring agent in paints for coating of toys. Groups administered feed containing no titani yellow were also prepared as controls.

The body weights of these animals were measured each day at a certain time with an automatic balance. Also conditions such as motility, appetite, and state of the fur were observed. The existence of nose-bleeds and changes of eye conditions were also observed and recorded.

The rats were sacrificed by bleeding after 90 days of dosage. The blood was examined and the weights and volumes of all the organs were measured. The results were compared to that of the control groups. Furthermore, the organs were dipped and fixed in formalin solution and their histopathologies were studied.

Identical experiments had been performed both on the original groups and on the control groups, and almost no differences were found between the two. Only the results of the original groups will be described here.

1. Prolonged growth experiment on rats being administered daily with titani yellow.

Experiment with comparison to control group.

Rats with average body weight of 125.2g were raised under the same conditions as those fed with the test chemical and the

growths were observed. The body weights showed continuous gain and reached 283.8g after 90 days (Fig. 1, fig. 5 and table 1)

The growth curves were used as the standard for this experiment. The general conditions, amounts of feed and water taken, and the excrement conditions were also carefully observed, recorded, and compared to that of rats which were administered titani yellow.

2. Experiment with oral administration of titani yellow.

i) Continuous dose of feed containing 1% of titani yellow for 90 days:

The body weights of the rats increased daily at a regular rate after the samples were administered and satisfactory results were shown. The body weights increased from 131.1g before administration to 279.8g after 90 days of dosage. No changes of any kind were found in their general conditions during this time. Although a slight loss of weight was witnessed while the constant temperature equipment was out of order and room temperature increased on the 48th day after dose of the sample, the tendencies were the same as that of the reference groups, and since then the increase in body weights were not affected. No differences could be found compared to the results of the control groups. (Fig. 2, fig. 5 and table 2).

ii) Continuous dose of feed containing 5% of titani yellow for 90 days.

The body weight of the rats increased daily at a regular rate after the sample was administered. The body weight increased from 131.1g before administration to 287.2g after 90 days of dose. The growth curves had no significant change during the time. Some of the rats lost weight around the 55th day due to loose bowels. However, the average curve was even better when compared to that of the control rats. No changes of any kind were found for the general conditions, and there was no difference when compared to that of the control rats. (Fig. 3, fig. 5, table 3)

iii) Continuous administration of feed containing 10% of titani yellow for 90 days.

The body weight of the rats also increased at a regular rate daily after the sample was administered. The body weight increased from 131.1g before administration to 300.3g after 90 days of dose. No abnormal sickness was found during the time. Appetites were the same as those of the control rats, and the fur conditions were excellent. There was one rat which had a light loose bowel and showed temporary decrease of body weight from the 41st day. The body weight increased again after that and no abnormal condition was found. This group of rats received the largest dose of feed. It had a better growth rate than the control group and showed the highest average of growth (Fig. 4, fig. 5 and table 4).

3. Studies of the weights and volumes of organs of the rats administered titani yellow versus those of control rats:

After 90 days of dosage, all rats were sacrificed by bleeding. The weights and volumes of all organs including cerebra, cerebella, thyroid glands, stomachs, hearts, livers, spleens, kidneys, adrenals, testicles and lungs were examined. The results are shown in table 5.

No remarkable difference was found between the group administered titani yellow and the control group, and there were also no remarkable differences among the rats in the first group.

4. Studies of blood of the rats administered titani yellow versus that of the control rats:

All rats were sacrificed by bleeding, blood samples were taken, and the general peripheral blood examination was performed. The percentage of white blood corpuscles was calculated from the count of red and white blood corpuscles and the amount of hemoglobin, color index and Giemsa stain of the test rats were compared to those of the control rats. The results are listed in table 6.

In regard to the blood corpuscle count, there was one example in the 1% administration group where the red blood corpuscle

count was lower than the others. However, the average value was almost the same as that of the control group. There was no abnormal condition of the white blood corpuscles. Neither the amount of hemoglobin nor color index showed any abnormal value and the percentage of white blood corpuscles was within the normal range.

5. Histopathological studies on the rats administered titanil yellow versus the control rats:

After the blood was examined and the weight and volume of all the organs of all rats were measured, each organ was fixed in formalin solution and dyed with Hematoxylin Eosine chromosome, and its histopathology was studied. (Fig. 9)

The gland structures of the stomachs were orderly and there was no abrasion of the stomach. No fatty and amyloid degenerations were found, and no stycosis was witnessed. The epitheliums and hypodermic organisms were normal. Neither bleeding erosion nor bleeding ulcer was observed. There was no atrophic or hypertrophic inflammation. The degenerative conditions such as hypertrophy, atrophy or necrosis of the gland cell and epithelium of the large and small intestines did not exist, neither did verrucositas degeneration nor pigment deposit. The increase of free cells in lamina propria mucosa was not found, nor were there any circulatory obstacles such as congestion, thrombus, hemorrhage, or edema in tunica submucosa. In the livers, no hepatomegaly, fatty and infiltrate degenerations, or deposits of imported pigment were found. The normal structures of the livers were all retained. In the kidneys, neither renal atrophy nor hydropynonephrosis had occurred. No abnormal deposits of fat and pigment were found, nor any degeneration. There was no hyperemia, swelling or degeneration in the glomerulus; neither were there degenerations of epitheliums of nephritic ducts, nor abnormal cylindrical formation. In the spleens, there were no follicular hypertrophies, pleocytosis, thesaurismosis or other degenerative states. Neither hyperemia nor congestion from circulatory obstacles was observed. In the hearts, no degenerative states such as substantial turbidity, steatosis or lime deposit were found. Neither hyperemia, congestion,

nor edema had occurred. There were no circulatory obstacles due to thrombus. There was neither endocarditis nor myoditis. In the lungs, there were abscess formations, but there was no necrosis. Neither arterial hyperemia, congestion, nor arteriorrhagia was found. There were no circulatory obstacles such as oedema pulmonum, embolia, or thrombus. There was neither growth inhibition nor inflammation, degeneration or neoplasma in the brains. No degeneration was found in the testicles. There was no degeneration, inflammation or circulatory obstacles in the pancreas. There were slight follicular hypertrophies in the thyroid glands. However, it was the same as that in the control group and not considered abnormal.

(B) Studies of the toxic action of titani yellow of various dosages in animals.

1. Studies of the effects on germination of plant seed.

The effect on the germination of seed of pleum pratense (Kinuito-gusa) was studied at room temperature for 10 days. The germination conditions of pleum pratense at various concentrations of titani yellow were shown in fig. 6. The higher concentration of titani yellow promoted the germination and growth more than the lower concentration when compared to the control plant. The order of promotion was 0.25% < control plant < 0.5% < 1% < 4%.

2. Studies of the toxic actions of large dosages on animals.

i) Dogs.

The general conditions and body weight changes were observed on three little dogs administered 1-3 g of titani yellow for 7 days. The results were shown in fig. 7 and table 7.

The body weight increased gradually, and no abnormal change was found in the general condition, especially the fur condition and spirit, except a temporary decrease of appetite. Yellow substances were found in the excrements after the administration of the test chemical and were identified as titani yellow. It was considered that all or most of the titani yellow was neither digested nor changed and was excreted through the digestive organs.

ii) Kittens.

The general conditions and body weight changes were observed for three kittens administered 0.5-2 g of titani yellow for 14 days. The results were shown in fig. 8 and table 8.

The body weights increased gradually after the administration, and no remarkable differences were found between the growth curves of this group and that of the control group. Among the general conditions, only mobility was decreased and crying increased slightly. There was a slight decrease in appetite 1 to 2 days after the sample was administered. Although not much food was left over, they were not eating it eagerly. The excretions were soft, and it was considered a temporary diarrhoea. Since the animals are in the growing stage, those with good general condition and excellent appetites were chosen as test kittens.

3. Effects on small fish.

Titani yellow was not soluble in water, and caused precipitation when mixed with water. Therefore, the solution was stirred continuously during the experiment.

i) Goldfish.

A group of five mature goldfish having a body length of 5 cm was placed in each of 1%, 2%, 4% and 8% aqueous solutions of titani yellow, and under the same conditions. Control goldfish were placed in their accustomed water. They were studied and compared. The numbers of fish surviving and the number of days they survived are listed in table 9. The movements of the goldfish in various concentrations of titani yellow were unchanged and also no differences were found when compared with that of the control group. Titani yellow was found sticking to the eyes, around the mouth, on the gills and on the entire surface of the fish. No changes in the parts to which titani yellow adhered were found.

ii) *Olizia latipes*.

Under the same conditions as were given for the goldfish, a group of 10 *olizia latipes* having a body length of 3 cm was placed in each of 0.5%, 1%, 2%, 4%, and 8% of aqueous solutions of titani yellow, and their reactions were studied.

There were no differences found when compared with the goldfish and with the control *olizia latipes*.

Some fish died. However, the percentage of deaths was almost the same in the control group, and it was considered a possible situation in a summertime experiment, and was not caused by the sample chemical.

IV. SUMMARY AND DISCUSSION

The experimental results were summarized as follows:

1) Feeds containing 1%, 5% and 10% of titani yellow were orally administered to rats continuously for 90 days. The growth curves of the above three groups of rats were compared to that of the control group of rats. The group with a 1% dose had almost the same curve as the control group and showed no difference. The groups with 5% and 10% doses showed slightly better results than the control group. More precisely speaking, the trend would be 10% dose > 5% dose > control group = 1% dose. The changes of body weight curves in fig. 5 showed no remarkable differences between the groups with various doses and the control group. The losses of body weight due to the leaks in the water supply and failure of constant temperature control were observed, but no losses of body weight were caused by the test substance. When the growth curves of the control rats in this experiment were compared to those of the experimental results of Hara^{14, 15, 18-24} of this laboratory, and to that of Hoshikawa¹⁶ and of Shibutani¹⁷ from their rat growth experiments or from the experiments testing various kinds of pharmaceuticals and food additives, no differences were found. Combining the observations of the general conditions of all the rats, none of toxic action of the titani yellow could be confirmed.

2) Examinations of the blood and the weight and volume measurements of all the organs of the rats receiving titani yellow daily for 90 days confirmed that there were no differences between these groups and the control group. Also, no histopathological disorder could be found.

3) Large amounts of titani yellow were orally administered to various kinds of animals, particularly kittens and dogs, and the toxic action was

studied. No abnormal effect was found. It was believed that this compound was either inactive or very nearly inactive.

4) The effect of titani yellow on the germination of plant seed was studied using *plcum pratense* as example. The test plant showed even better growth than the control plant. Therefore, it was believed that there was no toxic action of the compound on plant growth. However, it should be mentioned that the fact that the test plant showed better growth than the control plant was not due to the existence of a growth factor in titani yellow, but to the inhibition of water evaporation from the cotton pads that were used as the seed bed, and to the constant contamination of water in the cotton which would assist the germination and eventually help the growth of the plant.

5) 1% to 8% of titani yellow was used in water in which small fish were tested, and no difference was found when compared with the control group.

Since the titani yellow was not soluble in water, it was predicted that this compound would not display any ion action. In fact, no ion action was found for this compound in the experiment, even though it was contaminated with a small amount of antimony. It had been proved that this was due to the formation of a stable solid solution between antimony oxide and titanium oxide (TiO_2) and toxic action was shown. The ion actions of this and other rare-earth elements were first studied by Hara¹ of this laboratory and there were a few reports on this subject; it could be understood by comparing it with the results obtained by Tsubata^{12, 13} on titanium.

V. CONCLUSIONS AND JUDGMENTS

The following conclusions and judgments were made from the above results:

Titani yellow did not show any toxic symptoms when given to rats orally for a prolonged test period using the growth curves as the main standard. The rats administered with the test chemical showed no difference from the control rats, and there was no inhibition of growth.

There were no differences found between the two kinds of rats in their blood examination, weight and volume measurements of all the isolated organs, and also no alterations found in the histopathological studies.

Furthermore, titanium yellow had no effect on small fish, and did not inhibit the growth of plant seed. That is, no toxic activity due to ion action was found.

From the above results, it was found that this substance does not show any toxic symptoms at all.

It was confirmed that both the chief constituent titanium oxide and the small amount of antimony oxide showed no toxic action.

Therefore, it was predicted that this substance could be used safely as a coloring agent, particularly for paint, printing ink, and for coloring of synthetic resins and packing papers and containers for foods.

The evaluation of the results of the histopathological studies on the rats was made by Professor Odaka of the department of pathology of this University.

REFERENCES

1. Masukawa, et al, Japan Patent 35-10, 143 (1960).
2. H. H. Schaumann, U.S.P., 2, 257, 278 (1941).
3. Kino, 15th Meeting of Chemical Society of Japan (Apr. 1962).
4. J. Pick, et al, Med. Klinik., 33, 1270 (1911).
5. C. Richet, et al: Compt. R. Acad. Sci. Paris, 181, 1105 (1925).
6. L. Carozzi, Occupation and Health., 2, 1058 (1930).
7. Marui, Nippon Yakubutsugaku Zasshi, 8, 20 (1928).
8. L. Lendel, Hand b.d. exp. Pharmakol., 3, 1558 (1934).
9. M. Déribéri, Cline et Industrie., 47, 201 (1942).
10. S. Hara, Arch. exp. Path. Pharmakol., 100, 217 (1923).
11. Hara, Report of 4th Annual Meeting of Japan Physiological Society (1925).
12. Tsubata, J. Tokyo Med. College 19, 87 (1961).
13. Tsubata, *ibid*, 19, 101 (1961).
14. Hara, et al, *ibid*, 17, 1345 (1961).
15. Hara, et al, *ibid*, 18, 967 (1960).
16. Hoshikawa, *ibid*, 18, 951 (1960).
17. Shibutani, et al, *ibid*, 19, 329 (1961).
18. Hara, et al, *ibid*, 19, 1995 (1961).
19. Hara, et al, *ibid*, 20, 67 (1962).
20. Hara, et al, *ibid*, 20, 101 (1962).
21. Hara, et al, *ibid*, 20, 115 (1962).
22. Hara, et al, *ibid*, 20, 175 (1962).
23. Hara, et al, *ibid*, 20, 209 (1962).
24. Hara, et al, *ibid*, 20, 217 (1962).

TRANSLATION OF FIGURE AND TABLE CAPTIONS AND HEADINGS

(Note: The circled key numbers appearing next to Japanese characters in the figures or in the tables are correlated with the key numbers in the following list)

<u>Key No.</u>	<u>Translation</u>
1	Fig. 1. Body weight curves of the control rats (no test chemical administered)
2	Body weight of rat (g)
3	Date corresponding to the beginning of administration of test chemical
4	Number of days in experiment
5	Table 1 A. Changes of body weights of the control rats (no test chemical administered)
6	Dates of experiment
7	Number of days in experiment
8	Temperatures for animal environment (°C)
9	First day of the preliminary experiment before administration of test chemical
10	First group
11	Average
12	Amount of vegetable administered (g)
13	Cabbage
14	Table 1 B. Changes of body weights of the control rats (no test chemical administered)
15	Table 2 A. Changes of body weights of the rats orally administered feed containing 1% of titani yellow for 90 days
16	Second group
17	Date of beginning of administration of test chemical
18	Table 2 B. Changes of body weights of the rats orally administered feed containing 1% of titani yellow for 90 days
20*	Fig. 2. Body weight curves of the rats orally administered feed containing 1% of titani yellow for 90 days
21	Fig. 3. Body weight curves of the rats orally administered feed containing 5% of titani yellow for 90 days
22	Table 3 A. Changes of body weights of the rats orally administered feed containing 5% of titani yellow for 90 days
23	Third group
24	Table 3 B. Changes of body weights of the rats orally administered feed containing 5% of titani yellow for 90 days

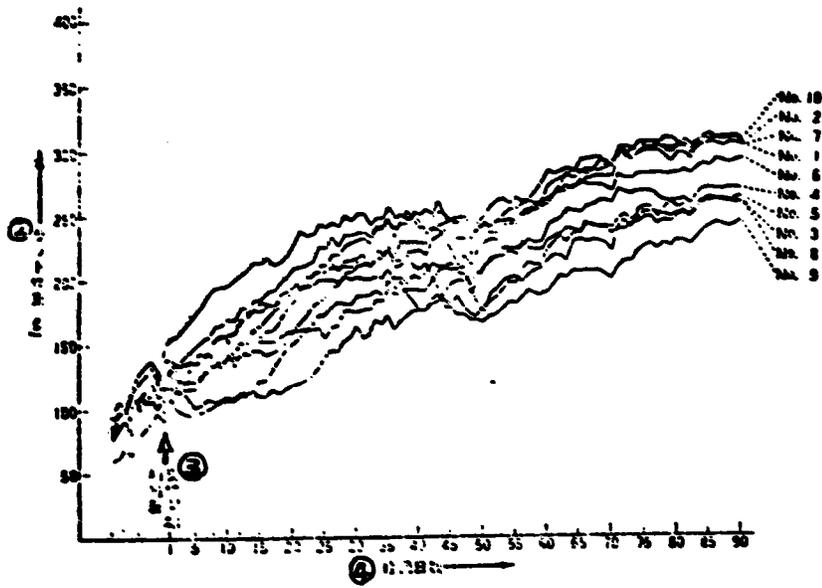
TRANSLATION OF CAPTIONS (cont'd)

- 25 Table 4 A. Changes of body weights of the rats orally administered feed containing 10% of titani yellow for 90 days
- 26 Fourth group
- 27 Table 4 B. Changes of body weights of the rats orally administered feed containing 10% of titani yellow for 90 days
- 28 Table 5. The weights and volumes of the brains and all the internal organs of the rats on the 91st day after 90 days of continuous administration of titani yellow
- 29 Group of rat
- 30 Number
- 31 Sex
- 32 Body weight
- 33 Cerebrum
- 34 Cerebellum
- 35 Thyroid gland
- 36 Stomach
- 37 Heart
- 38 Liver
- 39 Spleen
- 40 Kidney
- 41 Adrenal gland
- 42 Testicle
- 43 Lung
- 44 Weight
- 45 Volume
- 46 Left
- 47 Right
- 48 First group (control group without administration of test chemical)
- 49 Fig. 4. Body weight curves of the rats orally administered feed containing 10% of titani yellow for 90 days
- 50 Comparison of the body weight curves of the rats orally administered feed containing titani yellow for 90 days (average grams)
- 51 Table 6. The blood cell and hemoglobin count, the color index, and percentage of white blood corpuscles of the rats on the 91st day after 90 days of continuous administration of titani yellow
- 52 Group number of rat
- 53 Blood cell count
- 54 Red blood corpuscle count

TRANSLATION OF CAPTIONS (cont'd)

- 55 White blood corpuscle count
- 56 Hemoglobin count
- 57 Color index
- 58 Percentage of white blood corpuscles
- 59 Fig. 6. Growth curves of *placum pratense* at various concentrations of titani yellow
- 60 Height
- 61 Days
- 62 Fig. 7. Body weight curves of the dogs orally administered feed containing titani yellow for 7 days
- 63 Body weight of dog
- 64 Control (no titani yellow administered)
- 65 Table 7. Changes of body weight of the dogs orally administered feed containing titani yellow continuously for 7 days
- 66 Amount of feed administered
- 67 Table 8. Changes of body weight of the kittens orally administered feed containing titani yellow continuously for 14 days
- 68 Fig. 8. Body weight curves of the kittens orally administered feed containing titani yellow continuously for 14 days
- 69 Body weight of kitten
- 70 Table 9. The effects of titani yellow of various concentrations on the goldfish (experiment on acute toxicity)
- 71 Concentration (percent)
- 72 Water (control)
- 73 The numbers indicate the total survivors
- 74 Table 10. The effects of titani yellow of various concentrations on the *olizia lapetis* (experiment on acute toxicity)

① 第1回 熱処理時間との体積曲線 (g)



0096

⑤ 計1級人 無電照野上トの体高順位表 (尺)

21	22	23	24	25	26	27	28	29	30	31	31/VI	2	3	4	5	6	7	8	9	10	11	12
107	100	118	124	134	138	124	150	165	165	162	162	175	181	189	184	194	196	209	204	208	214	219
93	97	113	121	126	133	126	134	134	131	131	136	135	136	143	149	153	157	154	150	150	162	156
94	94	107	113	119	119	100	122	122	130	131	135	140	143	149	153	153	157	154	167	170	177	175
92	92	93	103	108	107	100	116	114	112	107	107	101	103	107	103	103	107	106	110	112	114	121
92	94	97	101	109	110	100	111	116	114	120	120	131	140	143	153	156	151	169	170	173	177	183
87	100	91	108	113	114	134	114	132	134	130	144	148	153	155	163	161	170	164	177	179	183	184
86	93	81	99	101	107	114	106	116	113	119	122	124	133	140	145	144	153	134	162	155	162	164
83	93	84	103	100	112	104	104	120	123	120	120	126	125	133	131	131	140	134	141	141	149	153
83	92	81	94	103	104	110	96	104	100	97	95	95	97	99	103	106	109	104	112	111	115	110
82	71	63	74	81	91	94	90	106	112	115	115	110	125	130	132	137	143	132	144	141	145	145
81.4	84.9	91.7	94.3	106.0	110.1	113.9	112.1	115.1	125.2	128.1	125.8	127.2	129.2	134.0	134.8	134.1	133.0	140.9	145.2	153.1	151.3	160.2

⑥ 計2級人 無電照野上トの体高順位表 (尺)

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	31/VI	2	3	4	5	6	7	8	9	10	11	12
182	190	180	180	181	187	192	195	195	198	200	201	201	201	207	215	212	211	211	211	210	217	210	211	211	211	210	217	210	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210	217	210	211	211	211
180	180	180	181	187	192	195	195	198	200	200	201	201	201	207	215	212	211	211	210	217	210	211	211	211	210					

第2表A 1%チロイネー含有原料をカットに建設 90 日開始日交付せる場合の体系推移表 (円)

(第1期) (第2期)

No.	1%チロイネー含有原料をカットに建設 90 日開始日交付せる場合の体系推移表 (円)																							
	21	22	23	24	25	26	27	28	29	30	31	1/VI	2	3	4	5	6	7	8	9	10	11	12	
1	97	101	111	121	128	131	142	150	152	154	155	157	159	160	163	147	137	130	130	131	131	134	146	
2	91	101	100	98	113	117	122	123	123	127	130	127	131	133	143	147	154	153	151	154	167	170	173	174
3	83	97	111	109	102	121	127	130	135	136	138	138	140	146	145	142	136	141	138	140	136	140	135	135
4	76	73	99	102	103	109	114	120	120	129	126	132	135	140	140	150	153	152	154	164	164	150	163	161
5	81	91	99	101	108	113	119	126	127	132	129	132	139	140	153	159	158	165	160	170	173	180	194	186
6	83	81	91	103	103	107	111	118	127	126	127	129	133	131	135	142	149	145	139	138	138	144	150	150
7	82	84	99	104	104	108	116	122	126	132	130	137	142	131	135	138	138	134	121	121	129	131	133	131
8	82	91	95	103	93	106	114	110	115	108	110	110	110	109	120	124	132	137	137	140	150	152	158	163
9	84	86	91	99	101	96	113	120	120	126	127	132	135	126	136	143	148	151	145	154	162	161	169	175
10	86	79	81	80	82	90	103	110	120	120	118	126	130	118	125	130	135	138	129	134	111	142	147	143
11	82.8	83.6	98.0	101.0	104.9	104.9	115.9	122.3	124.7	129.7	128.4	132.5	136.1	131.1	131.4	139.2	144.4	141.9	145.1	140.8	151.1	156.0	158.4	

No.	1%チロイネー含有原料をカットに建設 90 日開始日交付せる場合の体系推移表 (円)																														
	21	22	23	24	25	26	27	28	29	30	31	1/VI	2	3	4	5	6	7	8	9	10	11	12								
1	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1/VI	2	3	4	5	6	7	8	9	10	11	12	
2	176	180	178	181	184	190	189	191	191	182	201	193	201	190	202	198	208	209	212	202	200	217	219	218	238	263	263	258	258		
3	128	132	137	140	149	160	173	180	182	195	208	200	208	207	200	201	192	203	203	211	202	192	209	217	213	202	192	209	217	213	
4	164	174	172	173	179	180	182	189	191	177	193	180	193	193	190	194	180	193	196	199	193	189	205	207	213	205	207	207	198	198	
5	181	196	199	201	205	223	210	222	220	201	228	214	218	217	214	214	200	210	211	215	205	197	214	216	218	214	216	218	218	218	
6	152	150	148	154	149	158	151	153	152	162	153	150	144	153	147	149	150	153	155	150	138	158	161	167	170	167	170	170	172	172	
7	130	127	120	116	119	120	129	133	135	144	154	158	142	142	147	149	150	153	158	161	162	168	163	171	172	168	163	171	172	172	
8	166	163	177	183	192	191	202	200	217	215	223	228	231	239	243	242	243	251	259	252	258	257	262	253	253	253	253	253	253	253	253
9	170	181	183	187	190	192	188	191	193	194	202	198	199	203	208	209	208	220	221	230	220	212	216	223	215	215	215	215	215	215	215
10	137	133	131	138	143	147	153	155	162	163	168	171	173	177	180	183	185	190	191	190	192	190	198	198	197	198	198	198	198	198	198
11	157.1	161.0	162.1	165.7	169.3	173.8	178.2	183.1	187.7	194.4	191.1	191.2	195.0	195.0	191.0	198.8	199.8	204.1	201.9	208.3	203.6	200.7	214.7	209.3	209.3	209.3	209.3	209.3	209.3	209.3	

1. 1% ナイロ-合原料をワットに処理した際の収分率の体積百分率(%)

試料	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32																																		
収分率(%)	41	45	48	51	53	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90																									
体積百分率	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0

2. 1% ナイロ-合原料をワットに処理した際の収分率の体積百分率(%)

試料	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32																																		
収分率(%)	41	45	48	51	53	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90																									
体積百分率	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0

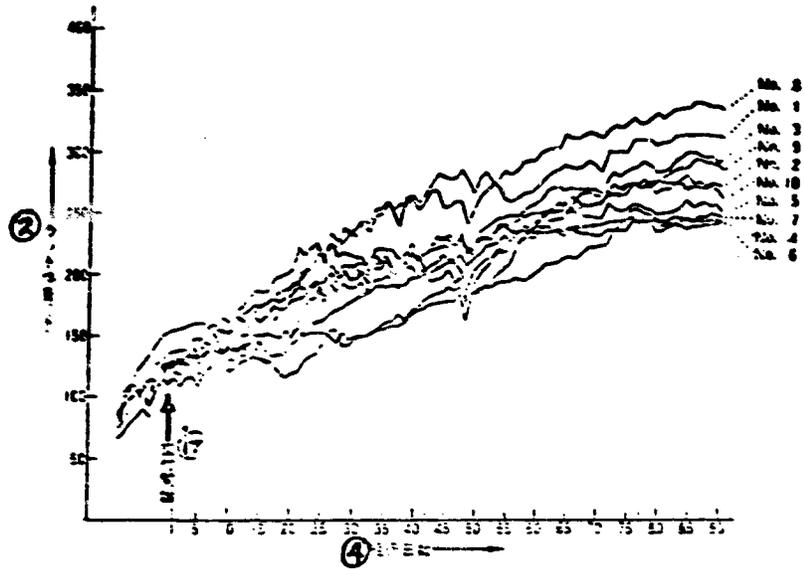
3. 1% ナイロ-合原料をワットに処理した際の収分率の体積百分率(%)

試料	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32																																		
収分率(%)	41	45	48	51	53	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90																									
体積百分率	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0

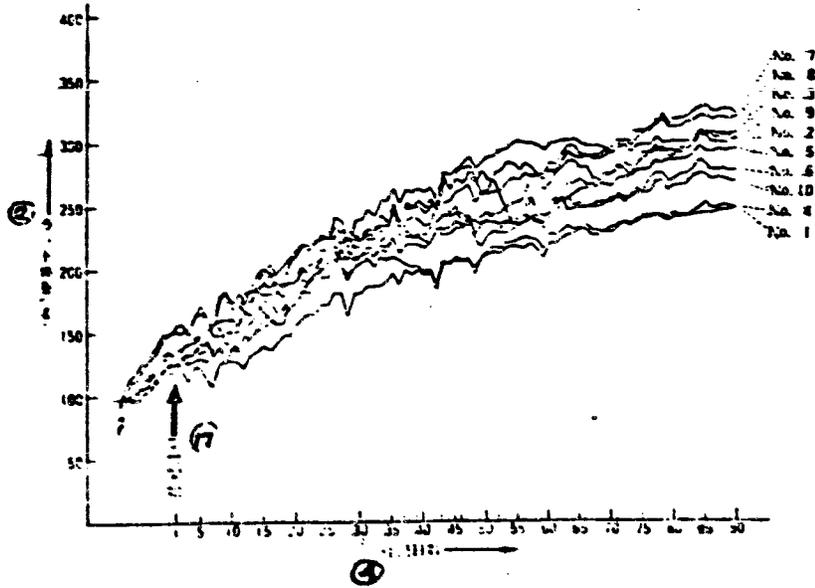
4. 1% ナイロ-合原料をワットに処理した際の収分率の体積百分率(%)

試料	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32																																		
収分率(%)	41	45	48	51	53	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90																									
体積百分率	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0

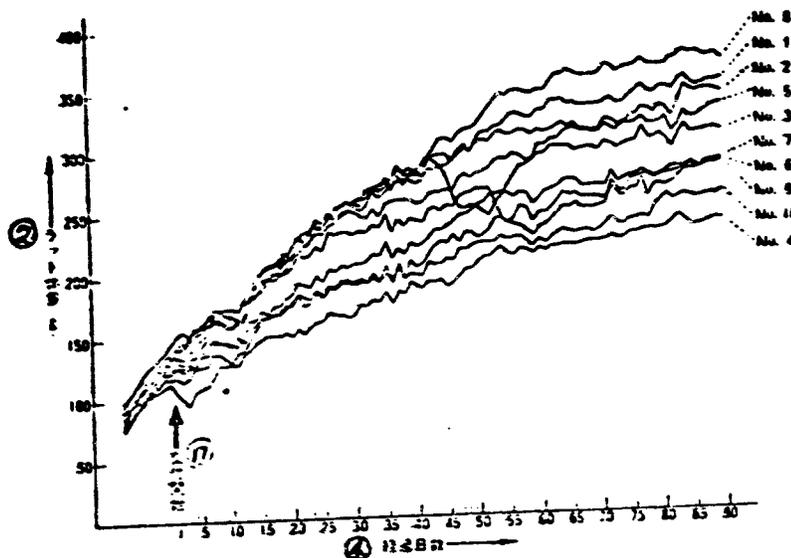
② 第2圖 1%チロニエロー含有飼料をラットに連続90日間
経口交付せる場合の体重増加(g)



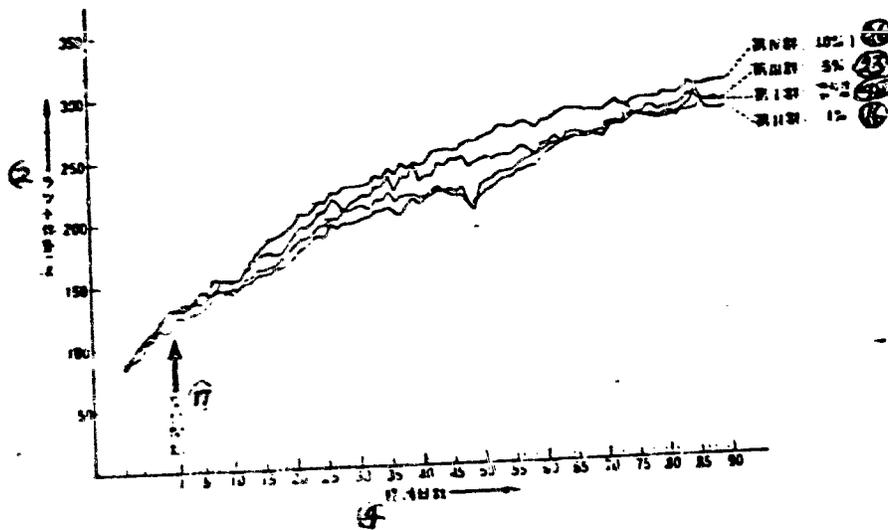
③ 第3圖 5%チロニエロー含有飼料をラットに連続90日間
経口交付せる場合の体重増加(g)



第4圖 10%チラニエロー含有飼料をラットに投与90日間
経口交付せる場合の体重増加(%)



第5圖 チラニエロー含有飼料をラットに投与90日間
経口交付せる場合の体重増加の比較(平均値)



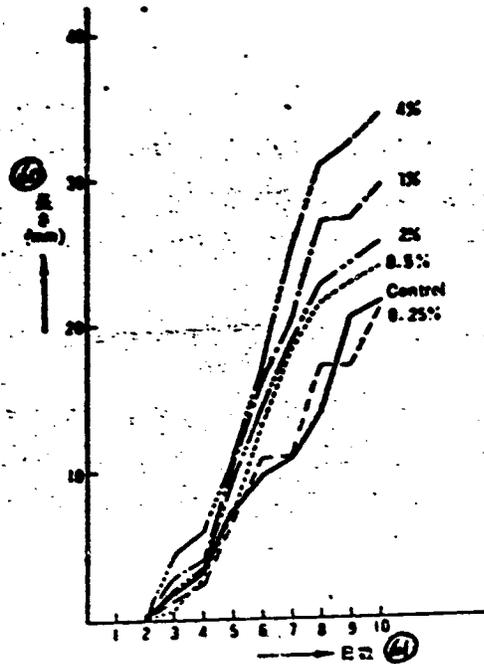
(1963年9月) 図. 外5名: 「チタニウム」の品位の行無に関する数理学的検査

- 127 -

第6表 チタニウムを1290日間定付せる場合の各群の平均品位の血球比、白血球比、白血球数および白血球百分率

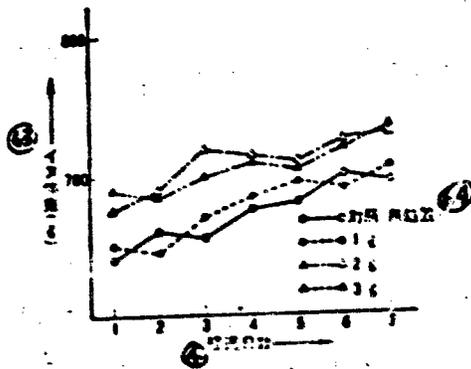
群別	No	試料	品位 (%)	白血球数	白血球百分率 (%)	白血球比	白血球百分率							
							B	E	N	L	Mo	Pt		
第1群	No1	8	306	800	6.700	103	.63	0	2	9	11	74	4	0
	2	308	745	8.700	104	.70	0	2	9	3	83	3	0	
	3	262	880	7.800	98	.57	1	1	7	10	76	3	0	
	4	272	720	9.900	94	.65	0	2	4	6	86	2	0	
	5	206	795	8.200	95	.60	0	0	9	17	72	2	0	
	6	296	500	6.800	85	.63	0	4	19	5	65	7	0	
	7	306	720	11.000	93	.65	1	1	13	9	71	3	0	
	8	262	700	7.100	64	.46	0	3	21	3	63	3	0	
	9	245	740	8.900	92	.53	0	2	14	7	76	1	0	
	10	212	580	7.400	66	.57	0	3	6	0	87	4	0	
平均	263.8	716	8.260	89	.63	0.2	2.0	11.1	7.3	75.8	3.6	0		
第2群	No1	8	312	790	9.500	93	.59	0	1	6	3	83	2	0
	2	273	735	8.500	95	.60	0	1	17	4	76	2	0	
	3	294	820	8.800	91	.55	0	2	14	1	82	1	0	
	4	244	680	6.700	91	.67	0	4	19	12	63	2	0	
	5	230	965	9.100	92	.47	0	2	8	6	84	0	0	
	6	244	635	7.600	91	.69	0	2	12	3	81	2	0	
	7	249	310	5.900	44	.71	0	1	18	15	61	3	0	
	8	331	605	7.300	97	.80	0	2	3	2	85	6	0	
	9	262	745	8.200	96	.61	0	2	18	11	64	3	0	
	10	288	670	7.300	89	.70	0	2	19	12	61	6	0	
平均	275.8	705	7.890	89	.69	0	1.9	13.6	6.9	74.5	3.1	0		
第3群	No1	8	246	230	8.300	89	.59	0	2	15	0	83	0	0
	2	260	865	8.800	91	.68	0	0	0	0	92	0	0	
	3	306	970	6.100	93	.68	0	2	7	1	87	2	0	
	4	246	810	5.900	96	.59	0	0	3	1	96	0	0	
	5	292	840	9.700	98	.53	0	0	2	3	92	3	0	
	6	276	920	9.300	95	.52	0	0	2	0	96	2	0	
	7	219	720	5.300	96	.52	0	1	2	23	73	1	0	
	8	218	820	8.800	96	.59	0	3	2	6	89	0	0	
	9	270	840	8.800	95	.56	0	3	0	16	87	0	0	
	10	267	1120	8.900	116	.52	0	2	1	22	75	0	0	
平均	267.2	846	7.750	97	.56	0	1.3	3.4	7.4	87	0.9	0		
第4群	No1	2	245	290	6.600	73	.68	0	5	8	0	88	1	0
	2	331	215	6.900	90	.52	0	0	0	3	86	3	0	
	3	221	275	7.700	91	.52	0	0	17	3	76	4	0	
	4	223	265	8.300	79	.52	0	5	9	26	59	0	0	
	5	224	285	8.700	74	.52	0	1	2	14	73	0	0	
	6	220	275	9.300	85	.52	0	1	0	21	78	0	0	
	7	225	230	5.300	78	.68	0	1	26	5	73	3	0	
	8	221	240	5.200	76	.52	0	2	0	13	85	0	0	
	9	220	280	8.700	74	.52	0	1	11	7	79	1	0	
	10	222	270	8.200	75	.68	0	3	2	22	73	0	0	
平均	249.3	271	7.450	79	.52	0	1.5	7.3	12.5	77.1	1.2	0		

第6圖 チラニエロー含有飼料による
豚舎育成曲線



7日 第7圖)

第7圖 チラニエロー含有飼料をイスに連続7日間
経口交付せる場合の体重推移 (g)



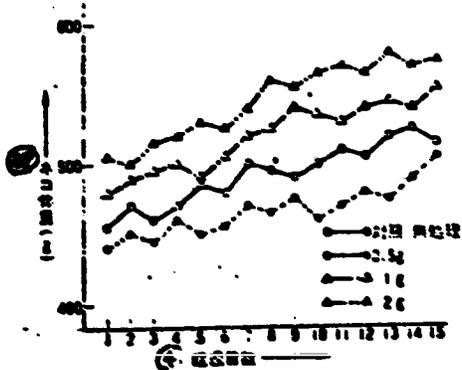
第7表 チラニエロー含有飼料をイスに連続7日間
経口交付せる場合の体重推移表 (g)

④ 経過日数	1	2	3	4	5	6	7
⑤ 実験日	26	27	28	29	30	31	1/1
⑥ 交付量	11.62						
⑦ 体重 (g)	640	660	655	675	680	700	695
1g	650	645	670	685	695	690	705
2g	675	690	730	715	710	725	730
3g	690	685	700	710	705	720	735

第8表 チタニウム含有飼料をトコニ添加14日経過後交付せる場合の体重変化 (g)

④→経過日数	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
⑤→実検日 25		26	27	28	29	30	1/11	2	3	4	5	6	7	8	9
⑥→交付%	1/62														
⑦→対照(%)	435	470	460	470	455	490	500	495	490	500	510	505	520	525	515
0.5g	440	450	445	460	450	455	470	465	475	480	470	480	475	490	505
1g	460	490	485	500	490	505	520	525	540	535	530	540	545	540	555
2g	505	500	515	520	530	525	540	560	555	565	570	565	580	570	575

第9表 チタニウム含有飼料をトコニ添加14日経過後交付せる場合の体重変化 (g)



第9表 キンギョに対するチタニウム各濃度の影響 (生存率実数)

④→経過日数	1	2	3	4	5	6	7
⑤→実検日 10							
⑥→濃度(%)	1/62	11	12	13	14	15	16
⑦→水(対照)	5	5	5	5	5	4	4
1	5	5	5	5	5	3	3
2	5	5	5	4	4	4	4
4	5	5	5	5	4	4	4
8	5	5	5	5	5	4	4

⑦数字は生存全数

第10表 ヒメダカに対するチタニウム各濃度の影響 (生存率実数)

④→経過日数	1	2	3	4	5	6	7
⑤→実検日 7							
⑥→濃度(%)	1/62	8	9	10	11	12	13
⑦→水(対照)	10	9	9	8	8	8	7
1	10	9	8	8	8	8	7
2	10	10	8	8	8	8	7
4	10	10	8	8	8	8	8
8	10	9	9	9	9	8	7

⑦数字は生存全数