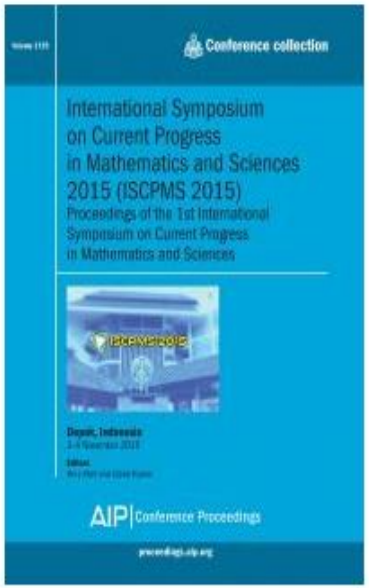


Volume 1729: International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)

Proceedings of the 1st International Symposium on Current Progress in Mathematics and Sciences

Edited by Terry Mart, and Djoko Triyono

Number of Volumes: 1
ISBN: 9780735413764

Volume 1729 is the proceedings of *International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)* (3-4 November 2015, Depok, Indonesia)

International Advisory Board, Scientific Committee, and Organizing Committee: International Symposium on Current Progress in Mathematics and Sciences 2015

Citation: AIP Conference Proceedings **1729**, 010002 (2016); doi: 10.1063/1.4946902
View online: http://dx.doi.org/10.1063/1.4946902
View Table of Contents: http://aip.scitation.org/toc/apc/1729/1
Published by the American Institute of Physics

International Advisory Board

Herman P Spaink (Leiden University, The Netherlands)
Yasuaki Einaga (Keio University, Japan)
Chang Uk Jung (Hankuk University of Foreign Studies, South Korea)
Akira Yokota (Universitas Indonesia, Indonesia)
Hisao Yoshida (Kyoto University, Japan)
Akrajas Ali Umar (UKM, Malaysia)
Nicholas A Hamilton (The University of Queensland, Australia)
Susumu Kajiwara (Tokyo Institute of Technology, Japan)
Beben Benyamin (The University of Queensland, Australia)
Gert van Helden (Leiden University, The Netherland)

Scientific Committee

Terry Mart (Chairman)
Djoko Triyono
M. Aziz Majidi
Dede Djuhana
Kiki Aryanti Sugeng
Hengki Tasman
Budi Nurani
Jatna Supriatna
Wellyzar Sjamsuridzal
Anom Bowolaksono
Ivandini Tribidasari
Jarnuzi Gunlazuardi
Eko Kusratmoko

International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)
AIP Conf. Proc. 1729, 010002-1–010002-2; doi: 10.1063/1.4946902
Published by AIP Publishing. 978-0-7354-1376-4/$30.00

Organizing Committee

Honorary Chairman	: Dr. rer. nat. Abdul Haris
	Dr. Ridla Bakri, M.Phil.
	Prof. Dr. Herman Spaink
Chairman	: Dr. Djoko Triyono
Co Chairman	: Dr. rer. nat Yasman
	Dr. Alhadi Bustamam
Secretary	: Dr. Noviar Andayani
	Dr. Ariadne L. Juwono
Treasury and Sponsorship	: Dr. Rokhmatuloh
	Dr. Tito Latif Indra
	Dr. Supriyanto Ardjo Prawiro
Programme	: Dr. Jarnuzi Gunlazuardi
	Aryanti Oetari, Ph.D
	Dr. Yuni K. Krisnandi
	Dr. Vivi Fauzia
	Dr. Dian Lestari
Secretariat	: Dr. Ratna Yuniati
	Cut Rulia, MSi.
	Indriyani, S.KM
Webmaster	: Dr. Adhi Harmoko
	Dedi Kurniawan
Documentation Publication	: Annisa Nurul Fitri
	Caya Mikail

Preface from the Editors: International Symposium on Current Progress in Mathematics and Sciences 2015

Citation: AIP Conference Proceedings **1729**, 010001 (2016); doi: 10.1063/1.4946901
View online: http://dx.doi.org/10.1063/1.4946901
View Table of Contents: http://aip.scitation.org/toc/apc/1729/1
Published by the American Institute of Physics

Preface From The Editors

The International Symposium on Current Progress in Mathematics and Sciences (ISCPMS) was successfully held in Depok from November 3rd to November 4th, 2015. In conjunction with the Third IndoMS International Conference on Mathematics and its Application (IICMA) the symposium attracted more than 148 participants coming not only from universities, but also from related research institutions. We are very delighted to present 82 papers in these proceedings after performing a standard review process to the presented papers and involving a number of leading scientists from Indonesia to this end.

The topics covered in this symposium include mathematics and natural sciences. These topics were intensively discussed in the parallel sessions of the symposium. In the plenary session a number of prominent scientists from Australia, Netherlands, Japan, Korea, Malaysia and Indonesia presented the latest findings of their cutting edge researches. We are very happy because these talks attracted almost all registered participants. We really hope that these presentations could inspire the participants to improve their researches as well as to find new bright ideas in their researches. It is also important to mention here that the symposium was aimed to provide a better communication medium among the scientists in Indonesia and surrounding countries.

We would like to thank the members of International Advisory Board and Scientific Committee for selecting the appropriate presentations as well as for selecting and asking the referees to review the selected papers. We are really indebted to the organizing committee for their hard work in preparing and executing this symposium. We also thank our generous sponsors, the Faculty of Mathematics and Natural Sciences, Directorate of Research and Community Engagement (DRPM) Universitas Indonesia, the Ministry of Research, Technology and Higher Education, for kindly supporting this symposium. Finally, we thank all participants for their contributions to this symposium.

Depok, March 2016

Editors
Terry Mart
Djoko Triyono

International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)
AIP Conf. Proc. 1729, 010001-1–010001-1; doi: 10.1063/1.4946901
Published by AIP Publishing. 978-0-7354-1376-4/$30.00

Sponsors: International Symposium on Current Progress in Mathematics and Sciences 2015

Citation: AIP Conference Proceedings **1729**, 010003 (2016); doi: 10.1063/1.4946903
View online: http://dx.doi.org/10.1063/1.4946903
View Table of Contents: http://aip.scitation.org/toc/apc/1729/1
Published by the American Institute of Physics

The International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)

held by

Faculty of Mathematics and Natural Sciences
Universitas Indonesia

Supported by

Univesitas Indonesia

Kemeristekdikti RI

International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)
AIP Conf. Proc. 1729, 010003-1–010003-1; doi: 10.1063/1.4946903
Published by AIP Publishing. 978-0-7354-1376-4/$30.00

Browse Volumes

1729

Submit

Browse Volumes

1841 (2017)

1848 (2017)

1840 (2017)

1847 (2017)

1832 (2017)

1846 (2017)

1844 (2017)

. Table of Contents

INTERNATIONAL SYMPOSIUM ON CURRENT PROGRESS IN MATHEMATICS AND SCIENCES 2015 (ISCPMS 2015): Proceedings of the 1st International Symposium on Current Progress in Mathematics and Sciences

Conference date: 3-4 November 2015
Location: Depok, Indonesia
ISBN: 978-0-7354-1376-4
Editors: Terry Mart and Djoko Triyono
Volume number: 1729
Published: Apr 19, 2016

DISPLAY : 20 50 100 all

PRELIMINARY

PRELIMINARY

Free . April 2016

Preface from the Editors: International Symposium on Current Progress in Mathematics and Sciences 2015

AIP Conference Proceedings **1729**, 010001 (2016); http://doi.org/10.1063/1.4946901

PDF ADD TO FAVORITES SHARE EXPORT CITATION

Free . April 2016

International Advisory Board, Scientific Committee, and Organizing Committee: International Symposium on Current Progress in Mathematics and Sciences 2015

AIP Conference Proceedings **1729**, 010002 (2016); http://doi.org/10.1063/1.4946902

Free . April 2016

Modification of cellulose acetate nanocomposite with TiO_2-organoclay as nanofiller and its self-photodegradation study

Siti Zahrotul Luthfiyah, Yuni. K. Krisnandi, Kadek Andhika, Riwandi Sihombing, and Adel Fisli

AIP Conference Proceedings **1729**, 020054 (2016); http://doi.org/10.1063/1.4946957

SHOW ABSTRACT | PDF ADD TO FAVORITES SHARE EXPORT CITATION

Free . April 2016

Zanamivir immobilized magnetic beads for voltammetric measurement of neuraminidase at gold-modified boron doped diamond electrode

Wulan Tri Wahyuni, Tribidasari A. Ivandini, Endang Saepudin, and Yasuaki Einaga

AIP Conference Proceedings **1729**, 020055 (2016); http://doi.org/10.1063/

Modification of cellulose acetate nanocomposite with TiO_2-organoclay as nanofiller and its self-photodegradation study

Siti Zahrotul Luthfiyah, Yuni. K. Krisnandi' , Kadek Andhika, Riwandi Sihombing, and Adel Fisli

Citation: AIP Conference Proceedings **1729**, 020054 (2016); doi: 10.1063/1.4946957
View online: http://dx.doi.org/10.1063/1.4946957
View Table of Contents: http://aip.scitation.org/toc/apc/1729/1
Published by the American Institute of Physics

Modification of Cellulose Acetate Nanocomposite with TiO_2-Organoclay as Nanofiller and Its Self-Photodegradation Study

Siti Zahrotul Luthfiyah[1], Yuni. K. Krisnandi[1, a)], Kadek Andhika[1], Riwandi Sihombing[1] and Adel Fisli[2]

[1]*Department of Chemistry, FMIPA, Universitas Indonesia, Kampus UI Depok, Indonesia*
[2]*National Nuclear Energy Agency, Serpong, South Tangerang*

[a)]Corresponding author: yuni.krisnandi@sci.ui.ac.id

Abstract Nanocomposite cellulose acetate has been synthesized using organoclay nanofiller modified with TiO_2. Tapanuli bentonite was previously subjected to purification and sodium exchangeprocesses, then modified with TiO_2,that was added as much as 0%, 1%, 3%, 5%, and 10% weight of the total composite. FTIR analysis showed intercalation with Hexadecyl Ammonium Bromide (HDTMABr) surfactant was successfully carried out, indicated by new absorption bands at 2636 cm^{-1} and 2569 cm^{-1}. XRD diffractogram shows the increase in basal spasing on the modification of bentonite from 15.7 Å to 19.7 Å after modification. Fabrication of nanocomposite film was carried out using acetone as solvent and through solvent casting method. Nanocomposite application in photodegradation test was carried out under direct sunlight irradiation, UV light, and without irradiation for six days. It is found that the greater the amount of TiO_2 in the composites, the more weight loss occured, due to photodegredation. Percent weight loss in the UV light irradiation are 1.11%, 2.15%, 2.73%, 3.18%, and 3.96%, while under direct sunlight irradiation, the weight loss was 1.03%, 3.03%, 3.88%, 4.53%, and 5.57%. Modification of nanocomposite with the addition of photocatalytic TiO_2 has shown to give the nanocomposite the ability of self-photodegradation.

INTRODUCTION

In the modern era, the use of plastics and other polymers has increased. Plastic has some advantages such as good durability, lightweight, easily manufactured, as well as cheap. These advantages in turn have a negative impact when it is not managed properly. The increasing amount of plastic waste thatdifficultto be biologically recycled has posed new problems needed to be solved.Photocatalytic oxidation is recommended as an environmental friendly way to degrade plastic waste [1]. Cellulose and its derivatives can be used to form more environmental friendly and biodegradable plastic polymers [2].

However, until now, the natural polymer still could not match the quality of the synthetic polymer.This problem can be circumvented by doing modifications of the natural polymer. Natural polymers can be formed into a nanocomposite [3] which is a combination of the polymer with the filler as a reinforcing network. The size of the composite is in nanometer thus the name nanocomposite. Based ondispersion of nanoparticles in a matrix composites, it is expected to form the desired physical properties of the composite.

Clay in Indonesia contained many montmorillonites, which are the main content of the bentonite. The characteristics of a montmorillonite is the high value of cation exchange capacity, good level of sweeling, large surface area, and easily decompose in nature [4]. Based on those characteristics, montmorillonite has the right characteristics to form a nanocomposite. The present of AlO_4^{5-}in SiO_4^{4-} silica layers has given the structure s a formal charge of -1, which is balanced by cations Ca^{2+} and Na^{+} cations [5].

International Symposium on Current Progress in Mathematics and Sciences 2015 (ISCPMS 2015)
AIP Conf. Proc. 1729, 020054-1–020054-4; doi: 10.1063/1.4946957
Published by AIP Publishing. 978-0-7354-1376-4/$30.00

Clay initially has hydrophilic properties [6]. Therefore, in order to be 'compatible' with organic compounds such as polymers, it needs to be modified so that it has organophylic properties [7]. Modification is often done by inserting a cationic surfactant into intergallery of bentonite to produce organoclay [8].

In our work, the organoclay was then modified with anatase TiO_2 in order to add photocatalytic properties to the composite. Until now, titanium dioxide still dominate photocatalytic applications. Generally, TiO_2 is added to the bentonite, as a pillar in intergallery of clay [1].

EXPERIMENTAL

Montmorillonite was intercalated using surfactant Hexadecyl Ammonium Bromide (HDTMABr). Photocatalytic agent used in this study is TiO_2. TiO_2 used is Degussa P25 which is a combination of rutile and anatase phases. All chemicals were used without further purification unless otherwise indicated resources. Acetone, NaOH (Sodium Hydroxide), NaCl (Sodium Chloride), Cellulose Asetate, TiO_2 (Titanium Dioxide).

Organoclay Synthesis. Tapanuli Bentonite was purified using pH 6 acetate buffer then carried cation exchange with 1M NaCl to form Na-bentonite purification. Na-bentonite purification was dispersed into aquabidest and surfactant (HDTMABr) by 1 CEC. The suspension was then stirred for 1 h at a temperature of 60 °C. After stirringwas completed, the suspension was sonicated for 3 minutes and decanted. The precipitation was then dried at a temperature of 70 °C.

Fabrication of TiO_2– organoclay-Cellulose Acetate. TiO_2withvariation of weight 1%, 3%, 5%, and 10% from the total composite wasdispersed with 7% organoclay from the total composite in acetone and stirred for 1 hour at 60 °C and then sonicated for 3 minutes at room temperature. TiO_2-organoclay that hasd been dispersed into acetone was then mixed into the cellulose acetate and stirred for 1 hour at room temperature followed by sonication process for 2 minutes. The suspension was poured into the bioplastic smold using stacked petri dishes and dried with a hotplate at 40 °C for 45 minutes. Synthesized TiO_2-organoclay/cellulose acetate labeled as in Table 1 below.

Self-Photodegradation Test. The synthesized TiO_2-organoclay/cellulose acetate was irradiated with two light sources which are UV light and direct sunlight. Each irradiation was performed 6 hours a day for six days. Irradiation with direct sunlight performed at 9:00 a.m to 4.00 p.m. Irradiation using UV lamps carried in a closed (wavelength range 280 nm - 320 nm and 8 W power) was carried in a closed reactor with the distance between the lamp and the sample was 17 cm. The irradiation was taken place at room temperature. Sample weighing tests were performed everyday. Irradiation test control was done by weighing six days composite without irradiation.

RESULTS AND DISCUSSION

Intercalation of Surfactant and TiO_2. Surface modification of clay minerals with surfactants is aimed to change the nature of the hydrophilic surface of the silicate into organophilic surface. This action is a strategic step in the preparation of clay to create a mineral that can absorb or react with organic pollutants [9].

In Figure 1, it can be seen that there is a new absorption band indicating that the surfactants HDTMABr been intercalated into the bentonite to form organoclay. The new absorption band is stretching vibration absorption band of symmetry and asymmetry CH_2 on the wave of 2928 cm^{-1} and 2851 cm^{-1} and CH_2 scissoring vibration absorption band at wave number 1409 cm^{-1} to 1538 cm^{-1}.

TABLE 1. Variation of Composite

No	Composite Name	Composition
1	0% CA-TiO2-organoclay	0.35g Organoclay + 4.65g CA
2	1% CA-TiO2-organoclay	0.35g Organoclay + 0.05g TiO2 + 4.55g CA
3	3% CA-TiO2-organoclay	0.35g Organoclay + 0.15g TiO2 + 4.5g CA
4	5% CA-TiO2-organoclay	0.35g Organoclay + 0.25 gr TiO2 + 4.4g CA
5	10% CA-TiO2-organoclay	0.35g Organoclay + 0.5g TiO2 + 4.15g CA

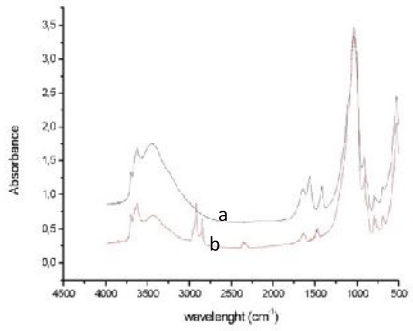


FIGURE 1. FTIR spectra pattern in (a) Purification of Bentonite Na (b) organoclay

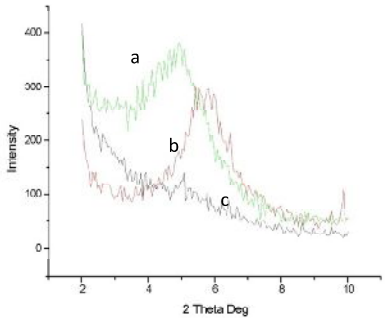


FIGURE 2. Low angle XRD pattern of (a) raw bentonite (b) 10% TiO_2-organoclay (c) organoclay

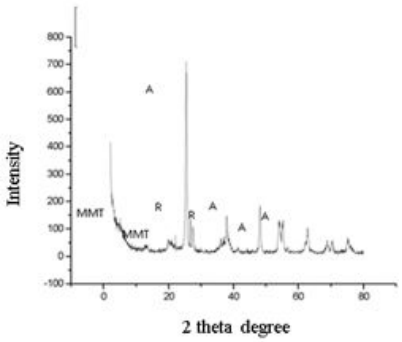


FIGURE 3. XRD pattern of 10% TiO_2 Organoclay (*A= Anatase, R = Rutile, MMT = Montmorillonite)

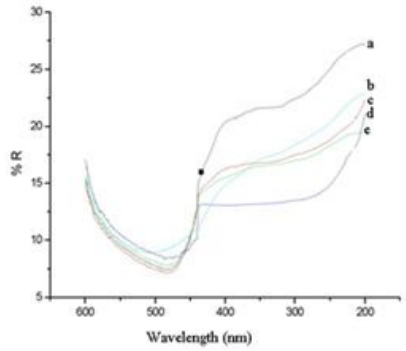


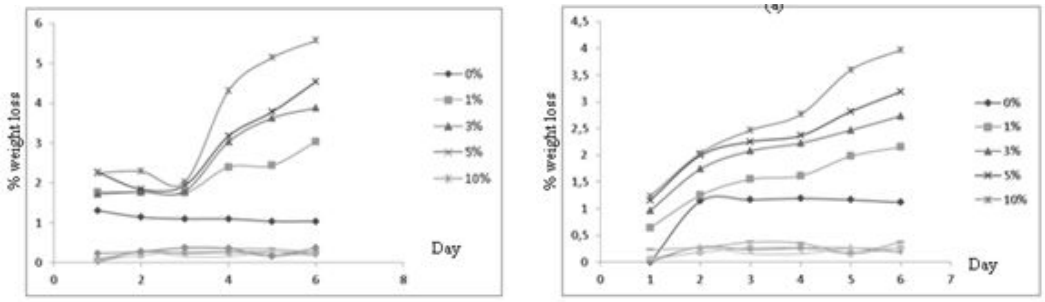
FIGURE 4. UV spectra DRS (a) 10% TiO_2-organic clay (b) 0% TiO_2-organoclay (c) 5% TiO_2 organoclay (d) 3% TiO_2-organoclay (e) 1% TiO_2-organoclay

TABLE 2. Energy band gap TiO_2 photocatalyst after dispersion on Cellulose Acetate Plastics

Photocatalyst	TiO_2	1% TiO_2 Film	3% TiO_2 film	5% TiO_2 Film	10% TiO_2 film
λ (nm)	413	434	428	409	402
Eg (eV)	3	2.85	2.89	3.03	3.08

In Fig. 2, XRD diffractogram was shown in 2 theta range of 2 °C to 10 °C to determine changes in the structure of bentonite as a result of treatment. In accordance with Jovicic *et al.* [10] characteristic peak of montmorillonite is in 5°, a (100) lattice plane. Purification and cation uniformity do not cause damage to the structure of the bentonite. This is indicatedby the significant changes that occur in the XRD pattern of MMT. Furthermore, when HDTMABr cationic surfactant was added, there was a shift in the basal spacing of the characteristic peak of bentonite into two smaller theta. By using the Bragg equation, it can be obtained that the shift come from the increase in the size of basal spasing of 15.1 Å (raw bentonite) to 19.7 Å (organoclay).

At 10% TiO_2-organoclay (Fig. 3), the characteristic peak of montmorillonite at 5° almost disappears.This indicates the organoclay has been covered by TiO_2 that has far more than the amount of montmorillonite. Figure 3 shows the diffractogram according to Degussa P25 TiO_2 diffractogram [11]. Figure 4 shows the UV DRS spectra of modified cellulose acetate composite and acetic sellose composite. It can be seen that the TiO_2-organoclay-/cellulose acetate 1%, 3%, 5%, and 10% have a value of λg nm at 434 nm, 428 nm, 409 nm and 402 nm, respectively. It can be seen that there has been a decreasing value in λg (blue shift). Decreasing of λg valuecaused increasing of Eg value. Eg value for each of the plastic composite photocatalyst TiO_2-organoclay-Cellulose Acetate were summarized in Table 2.



(a) (b)

FIGURE 5. Graphic of (a) Composite Irradiation with Direct Sunlight (b) Irradiation with UV-B at room temperature

Figure 5(a) displays a graph of percent weight loss of the cellulose acetate composite with variation of the addition of TiO_2-organoclay over time with irradiation using UV-B light having wavelength of 280-315 nm. There is an increase in percent weight loss from the first day until the sixth day of irradiation for each composite sample. From the graph it is shown that time of radiation is directly proportional with percent weight loss caused by photodegradation. In Figure 5(b), solar radiation are strongly influenced by the intensity of sunlight on the day of testing. From looking at the pattern of radiation with UV light and sunlight, there was a common pattern that the increase of TiO_2 concentration in composite will cause the increase in reduction of the percent weight of the composite.

CONCLUSIONS

Fabrication of TiO_2-organoclay modified cellulose acetate composite has been carried out. The presence of TiO_2 in the composite causes severe reduction in the composite after irradiation with sunlight and UV light. This shows there is apotential of TiO_2-nanocomposite to become self-photodegradation composite.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the financial support given for this work by Cluster Grant with contract number 1868/UN2.R12/HKP.05.00/2015.

REFERENCES

1. D. Chen, G. Du, Q. Zhu and F. Zhou, J. Colloid Interface Sci. **409**, 151 (2013).
2. J. Puls, S. A. Wilson and D. Holter, J. Polym. Environ. **19**, 152 (2011).
3. P. Nawani, C. Burger, L. Rong, B. S. Hsiao and A. H. Tsou, Polymer. **64**, 19 (2015).
4. R. Greene- Kelly, Mineral Mag. **30**, 604 (1955).
5. H. Yamada, H. Nakazawa, T. Fujita and K. Yoshioka, Clay Miner. **26**, 359 (1991).
6. Syuhada, R. Wijaya, Jayatin and S. Rohman, J. Nano Saintek. **2**, 48 (2009).
7. H. He *et al.*, in *Proceedings of the 9th International Congress for Applied Mineralogy* (The Australasian Institute of Mining and Metalurgi, Victoria, 2008), 321.
8. F. J. Rodriguez, A. Coloma, M. J. Galotto, A. Guarda and J. E. Bruna, Polym. Degrad. Stab. **97**, 1996 (2012).
9. F. Bergaya and G. Lagaly, in *Handbook of Clay Science*, edited by F. Bergaya, B. K. G. Theng and G. Lagaly (Elseiver, Amsterdam, 2006), 1.
10. N. Jovic-Jovicic *et al.*, Acta Phys. Pol. A **117**(5), 849 (2010).
11. M. R. Usman, A. R. Noviyanti and D. R. Eddy, available at https://pustaka.unpad.ac.id/wp-content/uploads/2015/06/Sintesis-Titanium-Dioksida.pdf.