PROCEEDING

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"Environmental based on Science Research for a Better Life

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PREFACE
VICE RECTOR III
ANDALAS UNIVERSITY

Assalammu'alaikum Wr. Wb

All praises be to Allah, the Almighty, the creator of the world. May His peace and blessing be upon our prophet Muhammad SWT, the leader of messengers and guide of faithful.

Environmental problems are now becoming the hot issues which have need to solve by all of us, because these issues directly effect the quality of humans life on earth. Therefore, as scientist we have to give more effort to give solutions on those issues.

This proceeding is useful as a guide to fix those issues, as the first step to keep the environmental safe for our next generation.

Padang, 2012
Vice Rector III
Andalas University

Prof. Dr. H. Novesar Jamarun. MS
NIP. 1962 0506 198811 1001

FOREWORD
CHAIRMAN OF INTERNATIONAL SEMINAR ON
ENVIRONMENTAL SCIENCE (ISES) 2012
UNIVERSITY ANDALAS

Assalamu'alaikum warahmatullahi wabarakatuh.
praise to Allah, because Allah give us healty, mercy and blassing. Peace be upon to our propeth Muhammad SAW.

We are know, Our enviromental condition has been increasiny to disaster, it cause global warming, the core of the problem and it attracts us as scientist to solve those problems by using research variotions to keep the enviromental from dangerous.

We hope with this seminar will expose and give us information as scientist to know that the research about enviromental problems have been done and those research can be developed to solve the future enviromental problems.

Allah SWT said in Qur'an " The destruction occured on land and ocean is happened because human beings behaviours". So it is the obligation for us to keep our environment.

Padang, 2012
Chairman of ISES 2012
Andalas University

Riko Irwan, S.Si

Content

Towards a new type of science for successfully addressing the global challenges for humankind

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ABSTRACT.

Most current scientists are specialists who know a lot about a tiny area of their field. They tend to publish of their research results in papers and books that are solely accessible for their close peers, in terms of concepts, ideas, language, goals and approaches. This approach used to be highly successful in the past, and led to the thriving of the Western approach to science. However, this approach also contributed to the fragmented scientific world as we currently have it. Humankind is now facing major global challenges; successful addressing of these global challenges calls for a new type of science. We need generalists with a broader view, people with the talent to see structures and connections, trends and the emergence of solutions. Science in South-East Asia used to be different from the Western approach. An integrated worldview and a deep understanding (and appreciation) of natural phenomena paved the way for the Eastern holistic approach. Based on the specific example of biomimetics, which is an emerging new field that deals with the abstraction of good design from living nature for human applications in science, technology and the arts, the authors introduce a concept concerned with a new type of scientist, whose world view combines the inherent wisdom in South-East Asia with the Western approach to science, based on an education that concentrates on understanding instead of learning by heart. Such people would be apt to develop new tools and applications for a better future for humanity, successfully address global challenges and contribute to a tree of knowledge that is accessible for all.

Keywords: biomimetics, creativity, engineering, global challenges, interdisciplinarity, rainforest, scientific expeditions, South-East Asia, sustainability, tree of knowledge

An interesting thing is both membrane and prefilter can lower content of metal ions and microorganisms in the humic water (Table 1 and Table 2). Membrane without prefilter can decrease the content of metal ions between 27% - 40% and the content of microorganisms (*E. coli*) reached ± 90%.
The existence of prefilter was found to increase the efficiency of membrane in filtering the metal ions and microorganisms become to 73% - 88% and 98% respectively.

IV. CONCLUSION

Prefilter can improve the efficiency of the ceramic membrane modification, especially for the reduction of the content of some metal ions in the peat water from 27% - 40% to 73 - 88%. Likewise prefilter, can increase the of ceramic membrane performance in reducing the content of microorganisms, from 90% to 98%.

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The Effect of Sol-Gel Processing Variables on Structure Changes of TiO_2 Nanopartiles

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ABSTRACT The Structural change during the thermal treatment of TiO_2 by sol-gel derivatives was investigated by TGA-DTA, XRD and TEM. This method has been used to study physico-structural properties of the TiO_2 powder. These properties were discussed with respect to the experimental parameters. It is shown that, depending on sol formulations and annealing temperatures, a large range of crystallite size, crystallization degree, and surface morphology. The results showed that TiO_2 were confirmed to be amorphous, anatase and rutile phase indicated at temperature of 300–900^{0}C. Also showed was the effect of experimental variables such as thermal treatment, heating rate on structural changes and sizes of crystal.

Key word : Structure, TiO_2, nanoparticles, sol-gel

1. INTRODUCTION

Sol-gel processing has attracted wide attention due to its capability to control the structure of product. The sol-gel synthesis is a method which uses TiO_2 powder that gives more advantages as compared to other methods. The following are its strengths : (1) high productivity, (2) size and sturcture can easily be modified, (3) particle distribution is even and homogenous, (4) low temperature, (5) stoichiometri can freely be manipulated, (6) simple and environmental friendly.

The structure of TiO_2 products produced from sol-gel processes come into three types namely anatase, brookite and rutile.

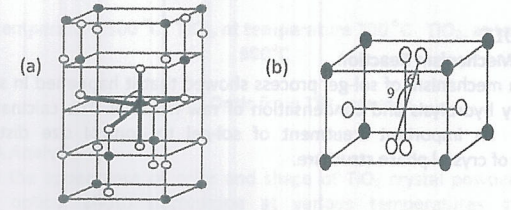


Fig 1. TiO_2 structure,(a) anatase and (b) rutil

Qourzal *et al.*, (2006) reported that anatase structure is formed at 400-500°C, whereas rutil structure at a higher temperature that is ≥ 600°C. The transformation tendency of anatase to rutil can take place at a higher temperature and thermodynamically rutil structure is more stable as compared to that of anastase as it is metastable in nature..

2. EXPERIMENTAL

2.1. Materials

All reagents used were of analytical grade purity and were of procured Merk Chemical Reagent, Titanium Isopropoksida (TIP : $C_{12}H_{28}O_4Ti$) (Aldrich, 97 %) as matric, Dietanol Amin (DEA : $NH(CH_2\ CH_2OH)_2$) merck as additive and Isopropanol (merck 98 %) as solvent

2.2 Preparation of TiO_2 nanoparticles

A solution of 7,32 mL of titanium tetraisopropoxide ($Ti[OCH(CH_3)_2]_4$ and 37,86 mL of isopropyl alcohol was mixed. Added then into the mixture was 4,82 mL Dietanol Amin (DEA) as additive. Total volume of sol was 50 mL with a composition of 1 : 2 (TIP and DEA) . Sol was homogenized for ± 2 hours. The stirring was done in hot plate at 100 rpm/minute in room temperature. The formation of Sol was in a closed reagent bottle to prevent isopropanol solvent from evaporation during the process of homogenization. Sol was then continued with the formation of gel by heating it in an oven at a temperature of 100-110°C for ± 5 hours. To produce TiO_2 powder, dry gel was then burned or calcinated at a temperature of 400-900°C inside a furnace with the flow of gas nitrogen gas and pressure of 100 psi for ± 2 hours. The powder produced was then eroded and characterized with the instrument tools to get to accurate information of the result of TiO_2 powder sysnthesis.

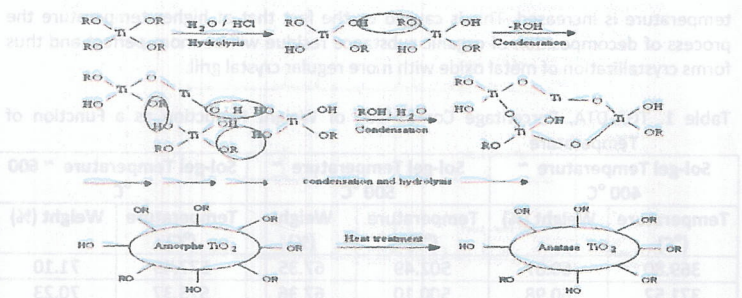
2.3 Characterization

The performance TiO_2 produced can be identified from a characterization of powder produced by means of testing or measuring using TGA-DTA equipment (Thermal Gravinetri / Diffrential Thermo Analysis), Photo Optic, XRD (X-ray Diffraction), and TEM (Transmission Electron Microscope.

3. RESULT

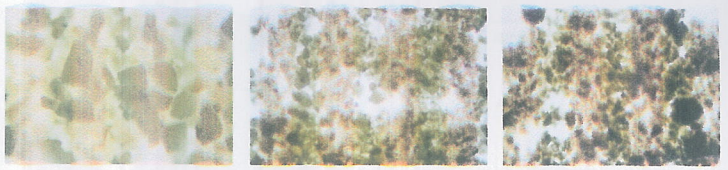
3.1 Sol-gel Mechanism Reaction

The reaction mechanism of sol-gel process showed that it happened in some reactive steps namely hydrolysis and condensation of raw material. The calcinations process which was an important treatment of sol-gel to control size distribution and morphology of crystal phase structure.



3.2 Foto Optic from TiO_2 powder

TiO_2, at temperature 300 °C TiO_2 , at temperature 400 °C TiO_2, at temperature 500°C



TiO_2, at temperature 500 °C TiO_2, at temperature 700 °C TiO_2, at temperature 900°C

Fig 1. Foto Optic from TiO_2 powder

3.3 TG-DTA Analysis

Fig.1 shows the appearance of color and shape of TiO_2 crystal powder as observed under the optical photo microscope at various temperatures at 100 times multiplication. The growth of crystal is more perfect when the calcination

temperature is increased. This is caused by the fact that at higher temperature the process of decomposition of organic substance residue will be more perfect and thus forms crystallization of metal oxide with more regular crystal grill.

Table 1. TGA-DTA, Percentage Comparison of Weight Reduction as a Function of Temperature

Sol-gel Temperature ~ 400 °C		Sol-gel Temperature ~ 500 °C		Sol-gel Temperature ~ 600 °C	
Temperature (°C)	Weight (%)	Temperature (°C)	Weight (%)	Temperature (°C)	Weight (%)
369.80	60.07	502.49	67.35	577.49	71.10
371.52	60.98	500.10	67.36	575.37	70.23
361.27	60.80	500.20	69.90	551.63	73.55

An analysis by X-Ray Diffraction on the pattern of TiO_2 powder showed that at calcination temperature of 300 - 900°C it produced crystal-look powder having anatase phase structure, rutil and the mixture of anatase-rutil. XRD pattern showed the highest difraction intensity as its main top pada at 2θ: 25.4° (101) with grill parameter of a : 3.780 A° and of c : 9.657 A° indentified as anatase structure and rutil structure was shown at 2θ: 27.4° (110) with grill parameter of a : 4.596A° and of c : 2.912A°. These data was obtained in reference to JCPDS (Joint Comitte Powder Diffraction Standard No. 12-2172, 1988). The measurement of crystal size by direct analisis with TEM showed a correlation between crystal sizes with those obtained from theoritical caculation using Debye-Schreer's formula from the data resulted from X-Ray Difraction.

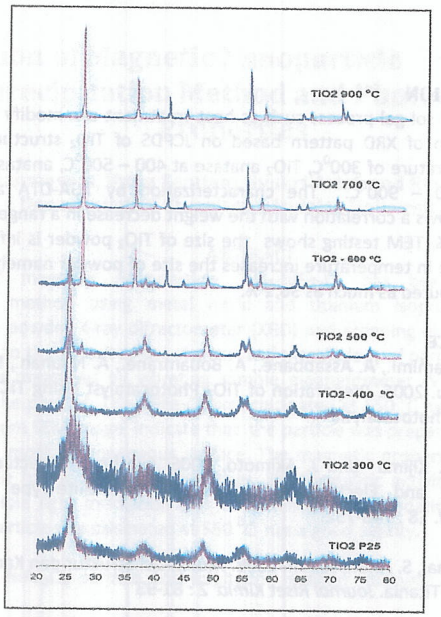


Fig 2. XRD pattern of TiO_2 powder sintered at various temperatures for 2 hr

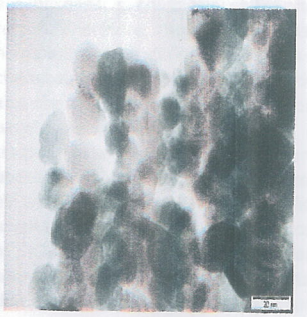


Fig 3. TEM pattern TiO_2

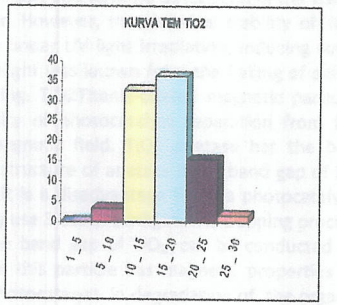


Fig 4. TiO_2 distribution percentage of nanoparticle size

4. CONCLUSION

Variable effect of sol-gel process such as heat treatment can modify the structure of TiO_2. Exploration of XRD pattern based on JCPDS of TiO_2 structure shows amorf pattern at temperature of 300^{0}C, TiO_2 anatase at 400 – 500^{0}C, anatase-rutil at 600 ^{0}C and rutil at 700 – 900^{0}C. The characterization by TGA-DTA at the previous temperatures shows a correlation with the weight decrease in a range of 60,4 ± 2.5 % up to 72 ± 3 %. TEM testing shows the size of TiO_2 powder is influenced by heat treatment - a rise in temperature increases the size of powder namely in the range of 15- 20 nm distributed as much as 36,1 %.

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Preparation of Magnetic Nanoparticle TiO_2 $NiFe_2O_4$ by Coprecipitation Method and Photocatalytic Properties

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ABSTRACT

Preparation of magnetic nanoparticle TiO_2-$NiFe_2O_4$ has been conducted by coprecipitation method using metal nitric and titanium isopropoxside (TIP) as precursors. The powder X-ray difractometer (XRD) and scanning electron microscopy (SEM) were use to characterized the structur and morphology of particle. The magnetic properties were measured by vibrating sample magnetometer (VSM). In the XRD patterns show the peak of TiO_2-$NiFe_2O_4$ was calcinated at 550 ^{0}C has high intensity of TiO_2 anatase. From SEM image indicate that the particle was prepared using propanol solvent has the most homogeneous surface. The magnetic properties analysis show that the particle has a magnetic properties. Photocatalitic activity of samples in response to visible light irradiation was determined by degradation of rhodamin B show that the particle was calsinated at 550 ^{0}C has a good actifity.

Key words: TiO_2-$NiFe_2O_4$ particle, coprecipitation method, magnetic and photocatalitic properties

1. INTRODUCTION

TiO2 powders have been commonly used as white pigments from ancient times. They are inexpensive, chemically stable and harmless, and have no absorption in the visible region. Therefore, they have a white color. However, the chemical stability of TiO2 holds only in the dark. Instead, it is active under UV light irradiation, inducing some chemical reactions. Such activity under sunlight was known from the flaking of paints and the degradation of fabrics incorporating. TiO2Titania-coated magnetic particles have been proposed to solve the difficulty of photocatalyst separation from the treated water by applying an external magnetic field. TiO_2, anatase has the best photocatalytic activity. This is because the structure of anatase has a band gap of 3.2 eV which is active on UV light irradiation. It is a disadvantage for this photocatalytic when used in sunlight because TiO_2 can only use 3-5% of sunlight. The dopping process of TiO_2 with $NiFe_2O_3$ metal to decrease the band gap of TiO_2 can be conducted by coprecipitation method. The advantages of this particle has magnetic properties so that can be recycled when it was used as photocatalyst in degradation of the organic compound in waste water.