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The International Conference Research Collaboration of Environmental Science

PREFACE

We would like to thank God for the blessing of International Conference Research Collaboration that was held on 12th March 2018 by The Biology Department, Faculty of Science and Technology, Universitas Airlangga. This conference is purposed to build promising international networking between our department, The University of Kitakyushu Japan, and some other Universities (Universitas Andalas, Universitas lampung, Universitas Pasundan, Universitas Pendidikan Indonesia, Institut Teknologi Bandung, Universitas Negeri malang, Universitas Padjadjaran, Universitas Langlangbuana, Universitas Sumatera Utara, Universitas Janabadra, and University Malaya, Malaysia), which have similar research interests for *Improvement of City Environmental Quality*. Hopefully through this seminar can help to improve the quality of our city environment.

We would like to thank Prof Toru Matsumoto who initiated and supported this conference. We would like to thank all the participants who have participated in this seminar, hopefully as the expectation of all parties.

We would like to also thanks the Faculty of Science and Technology Universitas Airlangga for supporting the conference. We give great appreciation to the committee who has worked very hard to keep the conference running on schedule.

Last but not least, we hope that real and excellent networking may arise in the future from this event.

Thank you and best regards
Surabaya, March 5th 2018
Head of Biology Department
Faculty of Science and Technology
Universitas Airlangga

Dr. Sucipto Hariyanto, DEA

Peer review statement

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Peer review statement

All papers published in this volume of *IOP Conference Series: Earth and Environmental Science* have been peer reviewed through processes administered by the proceedings Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

Table of contents

Volume 245

2019

Previous issue Next issue

The International Conference Research Collaboration of Environmental Science 12 March 2018, Universitas Airlangga, Surabaya, Indonesia

Open all abstracts

Preface

Papers

+ Open abstract View article PDF

OPEN ACCESS 012005

Improvement of campus environment quality: the feasibility study of the University of Lampung integrated waste management

I Kustiani and D Despa

+ Open abstract View article PDF

OPEN ACCESS 012006

Proximate characteristics of nano calcium in Blood Cockle (*Anadara granosa Liin*) shell from four different locations

S Widyastuti and D Evawati

+ Open abstract View article PDF

OPEN ACCESS 012007

Improvement of recycling-based municipal solid waste management in Padang City, West Sumatera, INDONESIA

S Raharjo, V S Bachtiar, Y Ruslinda, T Matsumoto and I Rachman

+ Open abstract View article PDF

OPEN ACCESS 012008

Application of GIS for the mapping of landslide-vulnerable areas by through android-based Analytical Hierarchy Process (AHP) method in Bantul Regency

Purbandini, R P Pratama and Susmiandri

+ Open abstract View article PDF

OPEN ACCESS 012009

Eco-cement production with alternative resources: recycling solution for shells ashes, organic husk ashes, organic waste ashes, and industrial sludge waste

N Citrasari, N G Pratiwi, S Hariyanto and L S Octavia

+ Open abstract View article PDF

OPEN ACCESS 012010

The design of Material Recovery Facilities (MRF)-based Temporary Disposal Site (TDS) at Universitas Airlangga campus C

N Citrasari, P S A Sitogasa, A L Burhan and N K Sari

+ Open abstract View article PDF

OPEN ACCESS 012011

The effectiveness of cellulolytic microbes and cow manure consortium for the composting technology of the garbage at the garden in Faculty of Science and Technology Airlangga University

T Surtiningsih and R Yusna

+ Open abstract View article PDF

OPEN ACCESS 012012

The planning of non-medical solid waste management at Universitas Airlangga Hospital

S Hariyanto, H N Rachmayani, N Citrasari, Z A Zalika and H M Faruqi

+ Open abstract View article PDF

OPEN ACCESS 012013

The correlation of sulfur dioxide length of exposure to c-reactive protein level of gas station employees in Medan Amplas District, Medan

T K Intan, A P Tarigan and Hidayati

+ Open abstract View article PDF

OPEN ACCESS 012014

Carbon dioxide estimation at Lampung University based on vehicle volume

S N Khotimah, N A Mardhotillah, D Despa and N Arifaini

+ Open abstract View article PDF

OPEN ACCESS 012015

Factors associated decrease of forced vital capacity on gas station employees exposed to sulfur dioxide (SO_2)

N N Soeroso, T K Intan and M Ichwan

+ Open abstract View article PDF

OPEN ACCESS 012016

Technical evaluation of leachate treatment plant at Klotok Landfill Kediri in 2017

D R M Isnadina, M. P. Adi and I. Ardiyanto

+ Open abstract View article PDF

OPEN ACCESS 012017

Removal of nitrogen-phosphorus in food wastewater treatment by the Anaerobic Baffled Reactor (ABR) and Rotating Biological Contactor (RBC)

N Hendrasarie and M N Trilta

+ Open abstract View article PDF

OPEN ACCESS 012018

Tracking of Dissolved Effluent Organic Matter (dEfOM) in wastewater treatment plant by using fluorescence method

E N Hidayah and O H Cahyonugroho

+ Open abstract View article PDF

OPEN ACCESS 012019

Ammonia removal from Yogyakarta Domestic Wastewater (WWTP-SEWON) by microalgae reactor with CO_2 addition

A U Farahdiba, W Budiantoro and A Yulianto

+ Open abstract View article PDF

OPEN ACCESS 012020

The potential of methane gas production at Klotok Landfill Kediri City

S Hariyanto, H H P Fatima, N Citrasari, S Sendari and M N Rasyidi

+ Open abstract View article PDF

OPEN ACCESS 012021

Study of household solid waste generation and composition in Medan City, Indonesia; a case study in Medan Labuhan and Medan Tuntungan

H Khair, D D S Mutia and T Matsumoto

+ Open abstract View article PDF

OPEN ACCESS 012022

Community based school improvement: a case study in Adiwiyata School at Malang

H A Syafrudie

+ Open abstract View article PDF

OPEN ACCESS 012023

Developing e-module of environmental health for gaining environmental hygiene awareness

S Sendari, R D Ratnaningrum, M L Ningrum, Y Rahmawati, H Rahmawati, T Matsumoto and I Rachman

+ Open abstract View article PDF

OPEN ACCESS 012024

A Study on the need of entrepreneurship local content curriculum in Bandung Senior High School

R Susilana, L Dewi and M Ali

+ Open abstract View article PDF

OPEN ACCESS 012025

PBL Method under the environmental education in Indonesia analyzing the influence of PBL Method into the knowledge attitude and behavior aspects

I Rachman and T Matsumoto

+ Open abstract View article PDF

OPEN ACCESS 012026

The development of Gestalt Hypnocounseling Training Module

B Soedarmadji

+ Open abstract View article PDF

OPEN ACCESS 012027

Implementation of environmental accounting in higher education solutions to improve the college's role in the implementation of corporate social responsibility

M Suhardiyah and Nurdina

+ Open abstract View article PDF

OPEN ACCESS 012028

Gender perceptions and adaptation strategies to climatic hazards-floods in rural areas of District Sialkot, Punjab, Pakistan

+ Open abstract View article PDF

OPEN ACCESS 012037

The design of geographic information system determination of slum area to improve villages in supporting green and clean in Surabaya City using Fuzzy-AHP method

Purbandini, M Weridianti and S D Puspitasari

+ Open abstract View article PDF

OPEN ACCESS 012038

Household waste management to improve the community economy via waste bank in Medan City

D Sriyanto and T K Intan

+ Open abstract View article PDF

OPEN ACCESS 012039

Innovative design of soil pressure modeling test apparatus to determine the amount of soil compaction energy to dry density value

L Afriani, I Adha and Setyanto

+ Open abstract View article PDF

OPEN ACCESS 012040

Analysis and projection of sea level rise in Medana Bay, North Lombok district

Tunas Gendewa Rancak, Suntoyo and Widi Agus Pratikto

+ Open abstract View article PDF

OPEN ACCESS 012041

Processing of plastic waste from Klotok Landfill Kediri City with thermal cracking method

A I Agusningtyas, N Citrasari, S Hariyanto and A F Maidi

+ Open abstract View article PDF

OPEN ACCESS 012042

The bioconversion of vegetable waste extract from Osowilangun Central Market Surabaya into bioethanol using *Saccharomyces cerevisiae*

A Supriyanto, I Lestari, N Citrasari and S S Putri

+ Open abstract View article PDF

OPEN ACCESS 012043

Developing electrical energy saving in State University of Malang

S Sendari, H Elmunsyah, Muladi and A N Afandi

+ Open abstract View article PDF

OPEN ACCESS 012044

Development of a rotary kiln reactor for pyrolytic oil production from waste tire in Indonesia

M Syamsiro, M S Dwicahyo, Y Sulistiawati, M Ridwan and N Citrasari

+ Open abstract View article PDF

OPEN ACCESS 012045

In situ synthesis process of nanographene and its characteristic

M Z Fahmi, V Andriyani, M F Dzikri, T P Armedya, M Wathoniyyah, D L N Wibowo and A J Permana

+ Open abstract View article PDF

OPEN ACCESS 012046

Excavated waste characteristic from Semarang City landfill sites. Part 1: physical characteristic

B Lokahita, A M Abadi, I N Hutabarat, L A Sembiring, R T Andrianingsih, G Samudro, H S Huboyo, M Aziz and F Takahashi

+ Open abstract View article PDF

OPEN ACCESS 012047

Small-scale production of biodiesel through transesterification process of waste or used cooking oil

A Agus and M Zahrul

+ Open abstract View article PDF

OPEN ACCESS 012048

Understandability and usefulness of news articles in explaining electricity generation from biomass: A comparative study on exact and non-exact science university students

D A Purwani, Z Mufrodi, A M Diponegoro, M K Biddinika and F Takahashi

+ Open abstract View article PDF

OPEN ACCESS 012049

Eco-efficiency and eco-innovation: strategy to improve sustainable environmental performance

W H Putri and N Y Sari

+ Open abstract View article PDF

OPEN ACCESS 012050

The role of waste compaction facility for reducing greenhouse gasses emission of waste transportation

M Chaerul and G M H Tompubolon

+ Open abstract View article PDF

OPEN ACCESS 012051

Effect of Solar Chimney and PCM cooling ceiling to the air flow inside a naturally-ventilated building

Suhendri

+ Open abstract View article PDF

OPEN ACCESS 012052

The geographic information system dashboard prototype of Brantas River, East Java

Taufik and B Nuqoba

+ Open abstract View article PDF

OPEN ACCESS 012

The reduction of carbon dioxide emission at 3R Superdepo Sutorejo waste processing unit (TPS),

Surabaya

T W C Putranto, S Hariyanto and S F Rifana

+ Open abstract View article PDF

OPEN ACCESS 012054

Economic analysis of the making of red brick without burning made from Foundry Sand and Paper Sludge waste

T W C Putranto and S E D F S Wati

+ Open abstract View article PDF

JOURNAL LINKS

Journal home

Journal scope

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Information for authors

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In situ synthesis process of nanographene and its characteristic

In situ synthesis process of nanographene and its characteristic

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Abstract. The results of the study of synthesis nano graphene from pyrolysis of tartaric acid compound obtained 29.8% yield. Crystallinity of nano graphene was analyzed by X-ray diffractometer and showed peak 2θ at 23.15° from the diffractogram. Nano graphene from tartaric acid has a particle size of 1 nm by the result of atomic force microscopy analysis. The photoluminescent properties were measured using spectrofluorometer with a 405 nm Diode Laser producing a peak at wavelength of 403.1 nm (blue region). Nano graphene maintain its stability in the pH range of 3-12 as well as on the addition of salt with concentration of 0.15 M; 0.30 M; and 0.50 M for 24 hours.

1. Introduction

Graphenes are flat monolayer of atom carbons tightly packed into two dimensional (2D) honeycomb lattice [1], which showed interesting properties to be applied in many fields. Graphene arranged one-atom thick layer of extended sp^2 carbon show extremely fast electron mobility and high charge carrier density which is interesting object to be studied [2]. However, single-layer graphene with nearly perfect structure lack of electronic band gap which cause this material not photoluminescence. Therefore, creating energy band gap can be a strategy to make graphene photoluminescent. Morphology of graphene, including size, shape, and thickness, effect the properties of graphene [3]. Cutting graphene into small pieces or directly producing small pieces of graphene can be one of strategy to make fluorescence emission in graphene [4]. The small pieces of graphene called nanographene which varying size from 1 to 100 nm. Nanographene shows intrinsic luminescence as a result of quantum confinement, surface defects and edge structure [2].

Nanographene can be synthesized through top down or bottom up method. In top down method, nanographene generally obtained by cutting carbon resources such as graphite power, carbon nanotubes, and carbon fibers [5]. However, this process cannot control the structure and size distribution of nanographene [6]. Besides, the method produces low yield products and require special equipment [7]. Meanwhile, bottom up method provide one step preparation and high yield percentage, which are efficient route to produce nanographene in large scale. Nanographene that synthesized using bottom up method can be obtained by self-assembly of polycyclic aromatic hydrocarbons (PAHs), organic synthesis from small molecules, carbonization of some organic precursors [5].

Carbonization process by thermal treatment allows precise control over morphologies and size distribution of products. Besides, this method can use common organic precursor. Our previous research used citric acid as organic precursor and selectively prepares GQD and GO by tuning the carbonization degree [8-10]. However, GQD obtained in this research contain of some incompletely carbonized citric acid. This probably due to citric acid structure, which consist of carboxylic substituent. When citric acid was heating in high temperature, its molecules will experience self-assembly to form six rings and leaving carboxylic substituent unreacted.

Citric acid can be replaced by tartaric acid, which has similarity application, such as dental filling and food preservatives. In this two application, tartaric acid and citric acid can be replaced for each other due to its similar properties and structure. However, tartaric acid structure are not contain of carboxylic substituent, which has probability to react completely forming nanographene.

Nanographene, which possess photoluminescence properties could be applied in biomedical field, such as diagnostic, near-infrared (NIR) light induced photothermal therapy and bioimaging. Therefore, in living organism, stability of material such as various acidity and salt solution, should be a concern for further application.

In this work, nanographene was synthesized from tartaric acid and characterized. Furthermore, stability of nanographene was also tested in various acidity and NaCl solution to discover whether it can be applied in biomedical field.

2. Experimental section

2.1. Materials and Chemicals

Tartaric acid was purchased from Sigma-Aldrich and sodium hydroxide are technical grade. Sodium chloride and hydrochloric acid were used to test the colloidal stability of nanographene.

2.2. Synthesis of nanographene

Nanographene was synthesized by direct pyrolysis method. 200 g of tartaric acid was placed on porcelain cup then is heated for 2 hours. The product of pyrolysis then cooled and dissolved in 10 ml of 2% NaOH. The obtained solutions filtered using membrane 0.22 μm to separate the bigger molecules of nanographene and unreacted tartaric acid.

2.3. Characterization of nanographene

The steady-state photoluminescence spectra were measured using fluorescence spectrophotometer. The nano-morphology of nanographene was studied by atomic force microscopy (AFM). FTIR spectra and X-ray Diffraction pattern of nanographene were also studied using FTIR spectrometer and X-ray diffraction instrument, respectively.

2.4. Nanographene stability analysis

Nanographene stability were tested by observing two parameters, stability at various acidity and addition of salt.

2.4.1. Stability of nanographene at various pH. Acidity of nanographene solution were set with addition of HCl and NaOH. The solutions made in 10 variation ranged of pH from 3 to 12. Each solution were observed whether any color degradation or precipitation.

2.4.2. Stability of nanographene with addition of NaCl. Sodium chloride with concentration 0.15 M, 0.3 M, and 0.5 M were added in nanographene solutions. Stability of solutions observed in 6 and 24 h.

3. Results and Discussion

3.1. XRD studies

Nanographene were synthesized by pyrolysis method. Tartaric acid were heated at 270°C for two hours. In high temperature, the molecules will decompose when temperature reach its melting point (168°C to 170°C). Furthermore, heating will cause self-assembly of atomic carbon to form its stable structure, which is 6-ring carbon. This process was growing to form graphitic structure, which called nanographene. The yield of nanographene obtained from this research was 29.8%.

Graphitic structure of nanographene were confirmed by XRD patterns (based on JCPDS26-1076) which showed broad peak at 2θ range 20° to 30°. This diffractogram pattern (Figure 1) showed d-spacing at 0.38 nm.

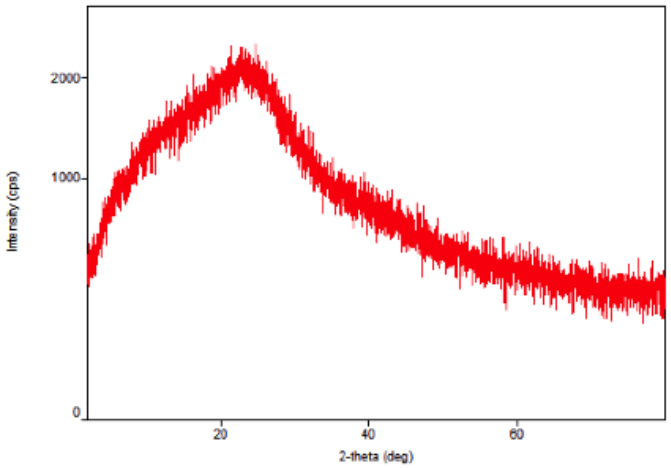

Figure 1. XRD Pattern of nanographene.

3.2. FTIR studies

FTIR spectra of nanographene exhibit absorption of OH group at 3630.03 cm^{-1} and carboxyl group at 1718.58 cm^{-1}, indicating that nanographene contain of –COOH group. Compared to broadness of OH peak in tartaric acid, nanographene shows smaller broadness which indicating that OH group in nanographene has been much reduced. The intensity of carboxylic peak for nanographene also lessen compared to tartaric acid peak. FTIR spectra indicated no absorption of C-H, which showed complete carbonized of tartaric acid. FTIR spectra shows on Figure 2.

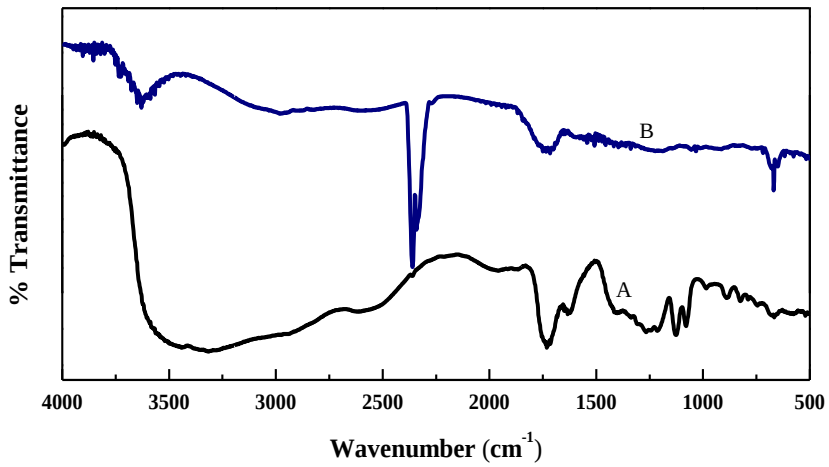

Figure 2. FTIR spectra of tartaric acid (A) and nanographene (B).

3.3. Atomic Force Microscopy analysis and Size measurement

Nanographene morphologies investigated using Atom Force Microscopy (AFM). Distribution of nanographene shows in Figure 3, which exhibit diverse size and shape.

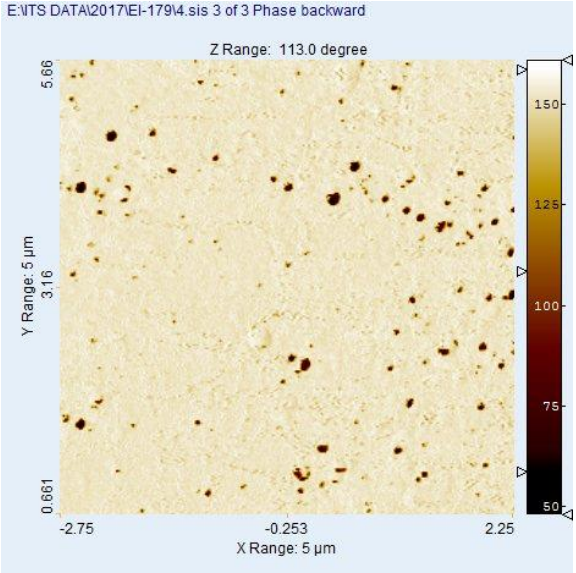

Figure 3. AFM image of nanographene.

Size distribution of nanographene analyzed using image j computer program. Size of nano graphene ranged 1 to 8 nm with average sizes are 1 and 2 nm. The result shows in Figure 4.

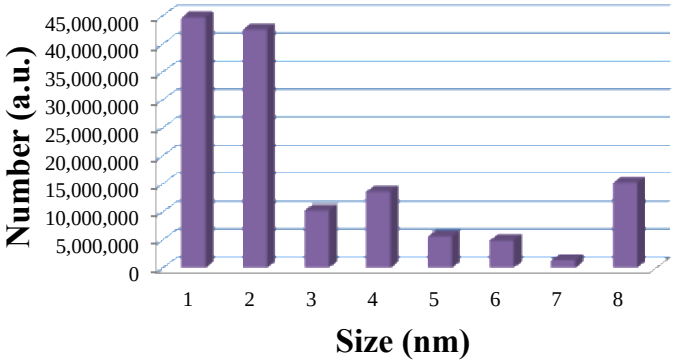

Figure 4. Size distribution of nanographene.

3.4. Photoluminescent analysis

Photoluminescence properties of nanographene analyzed by PL spectrophotometer. Nanographene solutions were excited using diode laser at wavelength 405 nm and the measured wavelength were 403.1 nm. Wavelength emitted from materials showed color spectra of photoluminescence quantitatively. Meanwhile, photoluminescence of nanograhene were range around blue light (from 450 to 500 nm). Therefore, blue light emitted by nanographene show the size of nanographene relatively small around 1 to 6 nm [5].

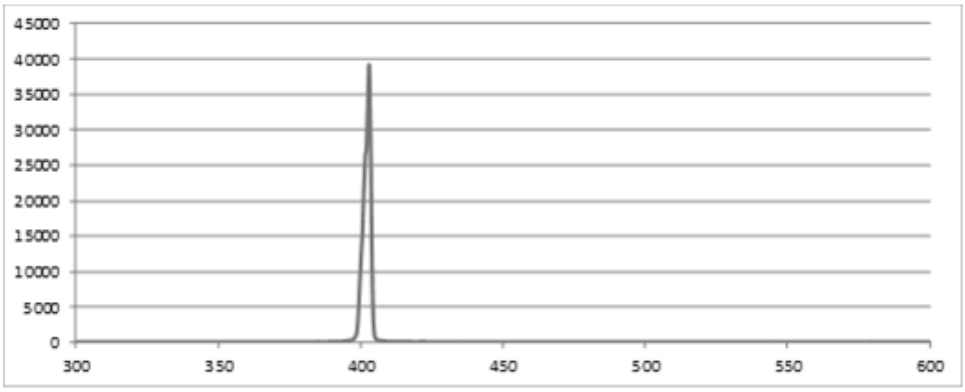

Figure 5. Photoluminescence of nanographene

3.5. Nanographene stability analysis

Stability of materials is one of condition of material to be used in biological system. Therefore, stability test is important parameter to be tested before being used in further application. Stability of nanographene was studied by setting two parameters, stability at various acid value (range pH 3 to 12) and stability at various salt concentrations. Stability of naonographenes at various acidity shows in Table 1 and stability at various salt concentration shows in Table 2.

4. Conclusions

Nanographene has been synthesized through pyrolysis method by heating tartaric acid as precursor at 270°C for two hours. Characterizations of nanographene showed that XRD pattern exhibit a broad peak range 20° to 30° which indicating graphitic structure. Size of nanographene was obtained on range 1 to 8 nm and emitting blue light photoluminescence. Nanographene considered as stable material, which can be applied further, in biological system.

Table 1. Stability of nanographene at various acidity

Duration (h)	pH Value										
	3	4	5	6	7	8	9	10	11	12	13
Control	-	-	-	-	-	-	-	-	-	-	-
6 h	-	-	-	-	-	-	-	-	-	-	-
24 h	-	-	-	-	-	-	-	-	-	-	-

Table 2. Stability of nanographene at various salt concentration

Duration (h)	NaCl concentration			
	0 M	0.15 M	0.3 M	0.5 M
Control	-	-	-	-
6 h	-	-	-	-
24 h	-	-	-	-

- No color degradation and no precipitation
+ Color degradation occurred and form precipitation

Stability test of nanographene at various acidity or salt concentration show no color degradation or precipitation. This results indicated that nanographene are tend to be stable.

5. Acknowledgment

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