IRSUWU 2018

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விஞ்ஞான, தொழில்நுட்பவியல் மற்றும் ஆராய்ச்சி அமைச்சு
Ministry of Science,Technology and Research

The Centre of Excellence for Value Addition

Uva Wellassa University

2nd International Research Symposium

"Emerging Technologies for an Innovative Green Economy"

February 1–2, 2018

Uva Wellassa University
Badulla
Sri Lanka

Synthesis of Expanded Graphite using Sri Lankan Vein Graphite via Ultrasonication

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Sri Lankan vein graphite, which is found in highly crystallized form with high purity (95 - 99 % carbon), have already been successfully developed for the anode of the lithium ion rechargeable battery. However, for their use in future energy storage applications, such as in sodium ion batteries, modification of the vein graphite structure is essential. Hence, this study focuses on structural modification of purified vein graphite by converting into expanded graphite via solvent assistant ultrasonication. Graphite oxide was synthesized from purified vein graphite by employing improved Hummer's method and then sonicated with propylene carbonate. The dried product was heated and again subjected to sonication with the same solvent. Then the solution was centrifuged to remove any non exfolliated graphite. Finally, the solution containing Graphite Oxide (GO) particles in PC were thermally reduced to produce reduced graphite oxide (rGO-PC). X-ray diffraction of crystal phase of the resulted graphite oxide shows the existence of a broad peak at 23.19 ° (2θ) corresponding to an interlayer spacing of 0.38 nm. The Fourier transform infrared spectrum obtained on the synthesized GO confirm the presence of O-H, C=O, COOH and C-O oxygen functionalities, which are then, confirm to be partly removed by the successive thermal treatment. Scanning electron microscopic images are evidence for the expanded structure with wrinkles and folded nature in contrast to the opaque and smooth structure observed in the pristine graphite. Altogether, these results confirm the successful formation of expanded graphite by the solvent assisted ultrasonication technique.

Keywords: Propylene carbonate, Sonication, Sri Lankan vein graphite, Graphene oxide

Antibacterial Activity of Silver Deposited Vein Graphite against Waterborne Pathogenic *Escherichia coli*

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The microbial contamination of drinking water is a major health problem in the world which requires an effective treatment. Silver ion (Ag^{+2}) is used as nonspecific antibacterial factor and it acts against a very broad spectrum of bacterial species. In this study, antibacterial efficiency of Ag deposited vein graphite were studied using *Escherichia coli* strain. Ag was deposited on the graphite surface by reduction of Ag^{+2} in silver nitrate solution using reducing agent. Scanning electron microphotographs of the Ag deposited graphite reveal that the deposited silver particles are highly agglomerated or spongy voids. Although the size of silver particle agglomerates are relatively coarse, the average size of individual silver nanoparticle is around 75 nm. Antibacterial efficacy of the synthesized sample was investigated using waterborne pathogenic *E. coli* strain. The antibacterial test was done using prepared composite samples and samples of *E. coli*, using shake flask method. A commercial antibiotic (Ofloxin-200 mg) was used as the positive control. The samples were drawn periodically (1, 1.5, 2, 2.5 and 3 hours) from the flask and tested against *E. coli* by plate count method using standard procedures. There was a significant *E. coli* removal efficiency by the synthesized Ag Graphite composite compared to purified graphite and positive control (One-way ANOVA, p-value=0.00). Therefore, this study suggests that Ag- vein graphite composite could be used as an effective material in water purification, especially in removing of *E. coli*.

Keywords: Graphite, Silver

Purification of Low Grade Quartz Bearing River Sand

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The demand for the high-grade quartz is increasing rapidly with the advancement of semiconductor and photovoltaic industries. Therefore, it is essential to enhance the purity of low grade quartz. Quartz bearing gravel, quartzite and, river and beach sand are the major low-grade silica sand deposits in Sri Lanka. In this study, a method was investigated to remove impurities in quartz bearing river sand depending on its mode of occurrence. Microscopic analysis implies that the impurities in the silica sand are present as mineral grains, coatings, interlocking grains and inclusions. In the physical purification process, sieving was carried out to separate river sand according to the grain size. The highest weight percentage of river sand is in the size range between 0.5 and 0.15 mm. This portion consists of more than 90% of quartz. Therefore, physical separation, depending on the grain sizes, can effectively use to remove the mineral grains present as impurities in quartz grains. Panning together with scrubbing and washing was carried out to remove the clay particles, heavy minerals and other undesirable materials present in the river sand. A chemical purification of physically separated river sand was carried out by acid leaching with 5 - 30 vol. % of HCl solutions in the temperature range between 27 and 100 °C. The mineralogical analysis and X-ray diffraction analysis imply the possibilities to remove iron oxide coating from the surface of quartz grains with low concentration of HCl, at low temperature. Accordingly, this physical separation and chemical treatment process is a more effective method to purify the low-grade river sand suitable for the advanced technological applications.

Keywords: Low grade quartz, Impurity, Purification, Acid leaching