UNIVERSITI TEKNOLOGI MARA

DEPOSITION OF FINE IRON OXIDE PARTICLES IN TAP WATER USING DIRECT CURRENT ELECTROPHORETIC DEPOSITION (EPD) TECHNIQUE

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Faculty of Chemical Engineering

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 27 August 2015 to conduct the final examination of Syahira Binti Mohd Sharif on her Master of Science in Chemical Engineering (by Research) thesis entitled "Deposition of Fine Iron Oxide Particles in Tap Water using Direct Current Electrophoretic Deposition (EPD) Technique' in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

An investigation of using electrophoretic deposition (EPD) technique to deposit negatively charge fine iron oxide particles in tap water samples on a counter charge electrode (anode) was conducted. Characterizations of fine iron oxide particles in tap water from two different locations i.e. commercial and residential areas, were identified. After centrifuging the tap water samples, particle analyzer was used to analyze particles sizes and zeta potential values. The average particle sizes for supernatant region from the commercial and residential areas were 230 ± 22.30 and 260 ± 3.68 nm respectively. The zeta potential value from residential area was higher than commercial area, i.e. -42.27 ± 0.12 and -34.83 ± 0.23 mV, respectively. X-Ray Diffraction (XRD) analysis indicated that the tap water samples consisted of iron oxide polymorphs, namely goethite (α-FeOOH), hematite (α-Fe_2O_3), magnetite (Fe_3O_4), and maghemite (γ-Fe_2O_3). During the removal of fine iron oxide particles using EPD technique, direct current (DC) voltage was varied from 5 to 25 V at a constant electrode distance of 30 mm. Higher deposition of fine iron oxide particles was achieved using the carbon fibre electrode with a percentage removal of (96% ± 1.42) than using the carbon plate electrode (58% ± 2.17) at 5 V due to the greater surface area of the carbon fibre electrode. The percentage of fine iron oxide particle deposition decreased as the applied voltage increased from 5 to 25 V. High amount of bubbles were formed on electrodes during EPD technique due to electrolysis of water as the applied voltage increased. The percentage removal of Fe from tap water samples from both areas was higher than the removal of Fe from the synthesized iron oxide suspension due to high zeta potential values in the water samples after centrifugation (supernatant). EPD techniques also manage to remove other element (arsenic) in tap water samples which had adsorbed onto fine iron oxide particles with percentage removal 26% ± 1.05. EDX analysis confirmed that fine iron oxide particles were deposited on anode electrode. The results proved that EPD was effective to remove fine iron oxide particles and other element such as arsenic in tap water.

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