Bacteria spectroscopic detection using amine-modified Fe_3O_4/C synthesized in submerged plasma arc discharge

Teguh Endah Saraswati [1], Anis Robi Astuti [1], Nana Rismana [1], and Masaaki Nagatsu [2]

[1]Sebelas Maret University, Indonesia

[2]Shizuoka University, Japan

This study aimed to synthesize amine-modified iron oxide/carbon (Fe_3O_4/C) nanoparticles as bacteria probe of Salmonella typhi. The synthesisprocess of nanoparticles was performed by plasma arc dischargemethod in liquid media ethanol and ethylendiamine with 1:1 volume ratio using carbon and carbon mixed Fe_3O_4. The diffractogram pattern of X-Ray Difraction (XRD) shows peaks at 35.59°;26.51°; and 37.79° represented to themain peak of iron oxide, graphite and iron carbide, respectively. The Fe_3O_4/Cmagnetic nanoparticles had sphericalconfiguration in a core-shell structure with iron core compoundcoated with carbon with a diameter of 10-40 nm. The successfulamine group attachment onnanoparticle surface was studied by X-ray photoelectron spectroscopy (XPS) showing the significant enhanced of N1s peak. Moreover, the amine group was also studied by FourierTransform Infra Red (FTIR)spectra at the N-H amine vibration,C-H stretching, C=O, C-Namine, and Fe-O stretching shown at 3418.97 cm^{-1};2850-3000 cm^{-1}; 1000-1700 cm^{-1}; 1000-1350 cm^{-1};and 489.94 cm^{-1},respectively. The amine groupscontained was estimated of 1.3268 $x10^{20}$ NH_2 functional group/gram nanoparticles which wasquantitatively analyzed by chemical derivatization by UV-Vis spectroscopy. In thispreliminary study, we successfully applied the synthesizedmaterial to enhance the detection signal of Salmonellatyphi bacteria using the spectroscopic technique. Significantly, thismaterial was able to increase the signal in the UV region that was suspected tobe the dominant signal of the bacteria. In addition, the total plate count(TPC) method with dilution and with the addition of this material was alsocarried out. The results show that the bacteria interacted with nanoparticles,thus the observation and calculation of bacterial colonies growth could be moreeasily performed.

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