Effective synthesis of biodiesel from *Jatropha curcas* oil using betaine assisted nanoparticle heterogeneous catalyst from eggshell of *Gallus domesticus*

ABSTRACT

The recovery of waste as feedstock away from organizational limitations corresponds to a prospective supplementary revenue stream for the organization. A novel waste eggshell of Gallus domesticus derived superbasic nanocatalyst was synthesized through betaine amphoteric surfactant-assisted decomposition, adsorption and precipitation processes. By varied the duration synthesis of gel mixture, the morphology transformation from liquid-solid interconnected macro-size particles to regular spheroidal nanoassemblies particles is detected. The surfactant at the liquid-solid interface facilitates the mono dispersion of nanoparticles by hindering growth of crystals. The average particle diameter of the produced superbasic nanocatalyst was in the range of 27e16 nm. The synthesized nanoparticle formation mechanism in the presence surfactant has also been addressed in this study. The catalytic activity of superbasic nanocatalyst was investigated for biodiesel production from crude Jatropha curcas oil (JCO) via glycerolysis and transesterification with methanol at atmospheric pressure. Artificial neural network (ANN) based on the genetic algorithm (GA) was applied for optimization of varied reaction parameters. It was observed that the reduction of acidity varied with varying reaction conditions. The highest fatty acid methyl ester (FAME) yield (97%) was obtained when the reaction was allowed to run at 60 C for 300 min, while at 90 C the maximal FAME yield of 98% was achieved after 120 min. The kinetic parameters of nanocatalyst were determined, and the reaction system followed pseudo first order kinetics. The results suggest that this two steps process using superbasic nanocatalyst affords a promising method to convert oils with high FFA level to biodiesel.

Keyword: Superbasic; Nanocatalyst; Free fatty acid; Glycerolysis; Biodiesel