Treatment of oily wastewater from waste glycerol by acidification and the coalescer process

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ABSTRACT

In this study, treatment of grease and oil (G&O) and other impurities in waste glycerol from biodiesel production was performed by a two-step process, by acidification and the coalescer process. 1 M hydrochloric acid (HCl) was used to acidify waste glycerol to destabilize the emulsion and remove the suspended solids (SS), soap and methyl ester. For acidification, a pH of 6 was selected, before testing with coalescer. The study was investigated with a wide range of factors and parameters including two media materials (polypropylene (PP) and polyethyleneterephthalate (PET)), two configure shapes (granular and fiber), pH (3–6), bed height (50–150 mm), and flow rate (5–18 dm³/h). The results of the study in the same experiment conditions showed, PP media material gave better results than PET media materials where the fiber sharp material performed better than the granular sharp material. G&O concentration of treated waste glycerol reduced to 0.081 g/L under operating conditions with 120 mm bed height, 5 dm³/h flow rate and PP fiber media.

Keywords: Acidification; Biodiesel; Coalescer; Emulsion; Waste glycerol

1. Introduction

In general, the transesterification process of biodiesel production produces about 10% glycerol as a by-product in every unit of biodiesel produced [1]. The total world production of biodiesel reaches up to 10.8 million tons per year [2], which means about 1.08 million tons of glycerol per year is produced, too. While the glycerol refinery demand market is limited, we are faced with the problem of managing this waste. It was reported that waste glycerol contains very high impurities include a pH of 9.7–10.4, chemical oxygen demand (COD) of 1,700–1,900 g/L, biological oxygen demand (BOD) of 900–1,200 g/L, total suspended solid of 213–387 g/L, and grease and oil (G&O) of 3.77–5.35 g/L [3]. Accordingly, treating waste glycerol by biological treatment is very difficult.

Waste glycerol has less economic value and due to its impurities, it is harmful to discharge into the environment [4]. To minimize the negative effects and to also make use of glycerol, research has been proposed to utilize this waste in several ways. For example, waste glycerol was used to convert to various of valuable chemical products such as 2-propanediol [5].