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Calcium Oxide Decomposed From Chicken's and Goat's Bones as Catalyst For Converting Discarded Cooking Oil to be Biodiesel

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Abstract - Thermal decomposition of calcium oxide from chicken's (*Gallus gallus domesticus*) and goat's (*Capra Hircus Aegragus*) bones was prepared at temperature variations of 400, 500, 800, 900, 1000, and 1100 °C respectively. X-ray diffractometer (XRD), FT-IR and SEM were used for calcium oxide characterization. XRD diffraction pattern of the bone's after thermal decomposition at 1100°C has similarity to the XRD standard diffraction pattern from Joint Committee on Powder Diffraction Standard (JCPDS). Diffractions of 2θ values being used are 34.2°, 37.3°, 58.3°, 64.1°, and 67.3°. Ca-O presence in the samples was detected by FT-IR characterization at wavenumber of 354,90 cm^{-1}. SEM profile show reducing size of bones after decomposition in both chicken's and goat's bones. Furthermore, the prepared calcium oxide was applied for biodiesel synthesis from discarded cooking oil through transesterification reaction. By applying the catalysts decomposed from chicken's and goat's bones, the biodiesel product showed characteristics as follows: biodiesel applied the chicken's bone catalyst has fatty acid number of 0.56 mg/KOH, iod number of 22.41 g I_2/100 g KOH, density of 0.88 g/cm^3 and viscosity of 5.91 mm^2/s, while biodiesel applied the goat's bone catalyst has 0.56 mg/KOH, iod number of 21.57 g I_2/100 g KOH, density of 0.88 g/cm^3 and viscosity of 6.34 mm^2/s. Those biodiesel's characteristic values meet the National Standard of Indonesia (SNI) for biodiesel.

Keywords: Biodiesel; Biscarded cooking oil; Calcium oxide; Chicken's bone; Goat's bone

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Introduction

Nowadays, biodiesel has become a very attractive biofuel; its environmental benefits including environmental friendly fuel and the availability of renewable resources can be used for biodiesel synthesis, these have increased the interest and demand for biodiesel (Kargbo, 2010). Biodiesel is known as a mono-alkyl ester of fatty acid with high energetic efficiency. Non-toxic fuel, no carbon dioxide, no sulfur emissions to the environment, and wider material resources available to be used are the considerable reasons for selecting biodiesel as transportation future fuel (Di Serio *et al.*, 2008). Various renewable sources such as vegetable oil, discarded cooking oil and animal fats can be synthesized into biodiesel (Ma and Hanna, 1999). The future of biodiesel as transportation fuel has received a considerable attention at this decade for fossil fuel substitution. Biodiesel can be synthesized easily through transesterification by the addition of acid or base catalysts (Di Serio *et al.* 2007).

Several catalysts have been prepared and reported as suitable for synthesis biodiesel, such as: conventional acid-base catalysts, it has been applied for transesterification of vegetable oil for biodiesel production. Examples of conventional acid-base catalysts currently used are hydrochloric acid, sulphuric acid, potassium hydroxide, and sodium hydroxide (Sharma *et al.*, 2008). These catalysts have been applied in homogeneous system and have many disadvantages and can reduce biodiesel as main product such as its potential to cause corrosion in equipments and required expensive separation during its application due to hydrolysis and saponification process, while acid catalyst is known to cause serious environmental and corrosion problem too. (Noiroj *et al.*, 2009). Heydarzadeh *et al.* (2010) reported the heterogeneous γ-alumina-zirconia as an effective catalyst for biodiesel production for various fatty acids. Macroporous-mesoporous materials are also can be used for biodiesel synthesis (Dahainaut *et al.*, 2010). Other than those studies, heteropolyacid nanoreactor