Characteristics And Mineral Content Of Lampung Tengah Ironsands

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Abstract. Characteristics and Mineral Content of Lampung Tengah Ironsands. This study is carried out to investigate the characteristics and mineral content of ironsands from Bekri, Lampung Tengah Regency by using precipitation method. The research was conducted in Physics Laboratory of Institut Teknologi Sumatera from June to September 2018. Mineral content of sand is analayzed with X-Ray Diffractometer. The extraction was varied in temperature and stirring time. The temperature is varied in 80oC, 120oC, dan 160oC and yields different size; 33.76 nm, 11.84 nm and 11.14 nm. Meanwhile, the extraction is varied for 2 hours, 4 hours and 6 hours stirring and yields particle with 43.12 nm, 11.14 nm and 11.32 size. Mineral content of ironsands in Lampung Tengah are dominated by Ilmenite and Potassium Chloride.

Keywords: Ironsands, XRD, Mineral Content

1. Introduction

Sand is one of the most abundance natural resources in Indonesia and usually used as material building compound. Generally, volcanic sands is the most exploited sand used for material building for its quality. The abundance of sands in Lampung Tengah Regency, especially in Bekri is not explored yet due to its poor characteristics for material building. Sands in this region is dominated by iron oxide such as magnetite (Fe_3O_4), maghemite (γ-Fe_2O_3) and hematite (α-Fe_2O_3). Magnetite (Fe_3O_4) which is the most dominant iron oxide has the strongest magnetism compare to other minerals mentioned. This magnetism information is very important for the next application, toner producing. Ataeefard [1] shows that toner synthesis needs a nanometer particle with uniform size distribution. The smaller size and uniform distribution of sand is necessary for the effectiveness of synthesis. Thus, it can the increasing the utilizing of ironsands [2] in Lampung Tengah.

Magnetit Fe_3O_4 in nano scale can be widely used in industrial raw material especially in electronic material which its demand is increasing lately. Magnetit characteristic have been studied further to investigate how the chemistry, physics and magnetism properties applied for a greater application. It is also has been used as magnetic nanocomposite material for contaminant absorbent in liquid waste treatment. Nanocomposite adsorb contaminant in the water and can separate it by using permanent magnet [3].

Some methods have been applied for producing Fe_3O_4 powder are spray pyrolysics, forced hydrolysis, oxidation and reduction reaction of iron hydroxide, microwave irradiation of iron hydroxide, sonochemical technique, hydrothermal, and chemical precipitation method [4]. The precipitation method is an alternative solution due to the lack of conventional ceramics method. In fact, base chemical synthesis of powder reactivity is one of the most effective method to decrease the sintering temperature of ferrite. Various method of chemical synthesis

are: coprecipitation, hydrothermal synthesis, sitrat precursor method, glass ceramics method and sol-gel process [4].
This research is carried out to synthesize magnetic nanoparticles of ironsands from Bekri, Lampung Tengah by using copresipitation method by adding acid and base of solution. The magnetic particle is aimed to be distribute uniformly as a basic compound for the next application.

2. Experimental Method

Syntheis of Fe_3O_4 Nano Particles from Ironsands

Fe_3O_4 is synthesized by using coprecipitation method. The ironsands which have been extracted by XRD was soluted in 35 ml HCL solution with temperature ~ 70° C and stirred around 30 minutes with magnetic stirrer. The reaction formula is stated as:

$$3Fe_3O_4\,(s) + 8HCl(l) \rightarrow 2FeCl_3\,(l) + FeCl_2\,(l) + 3Fe_2O_3(s) + 3H_2O(l) + H_2(g) \quad (3.1)$$

Soon after the solution was formed, the sample was filtered by using filter paper. NH_4OH was added to this solution while strirring and heating around ~ 70° C in 30 menit. The reaction process became:

$$2FeCl_3\,(l) + FeCl_2\,(l) + H_2O(l) + 8NH_4OH(l) \rightarrow Fe_3O_4(s) + 8NH_4Cl(l) + 5H_2O(l) \quad (3.2)$$

Aquades was used to clean the reaction process from the waste and filtering it. The cleaning process began with putting the reaction result in breaker glass and added aquades into the glass. Permanent magnet was placed on the bottom of the glass in order to attract Fe_3O_4 to precipitate faster than Fe_2O_3. While the precipitation was formed on the bottom, the waste was pour out slowly and Fe_3O_4 should remain on the bottom. This material was dried in microwave in 70° C for 2 hours.

Henceforth, we varied the temperature and stirring time. The material was dried in 80 ^oC, 120 ^oC dan 160 ^oC. meanwhile the stirring times are 2 hours, 4 hours and 6 hours.

Table 2.1. Temperature variation

Name	$t_{stirring}$ (jam)	HCL (mL)	NH4OH (mL)	T (^oC)
Sample A	2	35	25	80
Sample B	2	35	25	120
Sample C	2	35	25	160

Table 2.2 Time variation

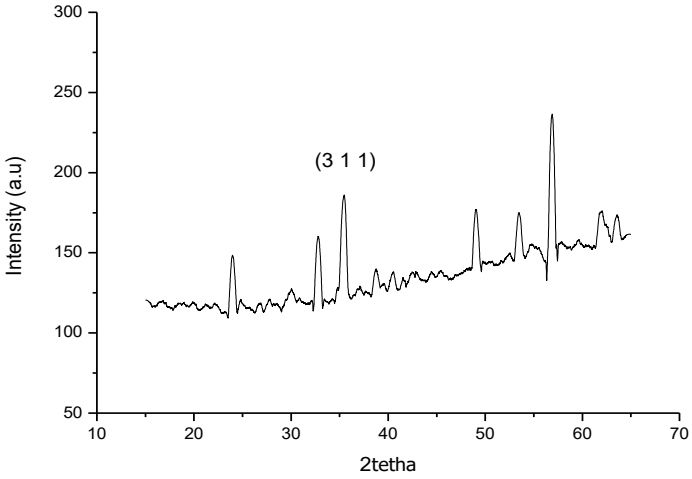
Name	$t_{stirring}$ (jam)	HCL (mL)	NH4OH (mL)	T (^oC)
Sample D	2	35	25	80
Sample E	4	35	25	80

3. Result and Discussion

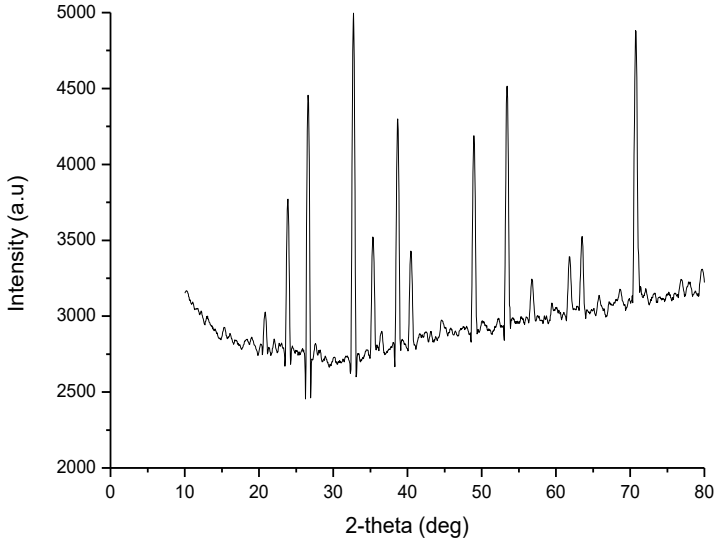
Synthesis of Fe_3O_4 Nano Particle from Ironsands

The Ironsands from Bekri, Lampung Tengah was synthesizing by using base precipitation method. The extract of ironsands was put in 35 ml solution and stirring was set in 70 ^oC and 30 minutes in magnetic stirrer. The characterization of ironsands from XRD is shown in Figure 3.1.

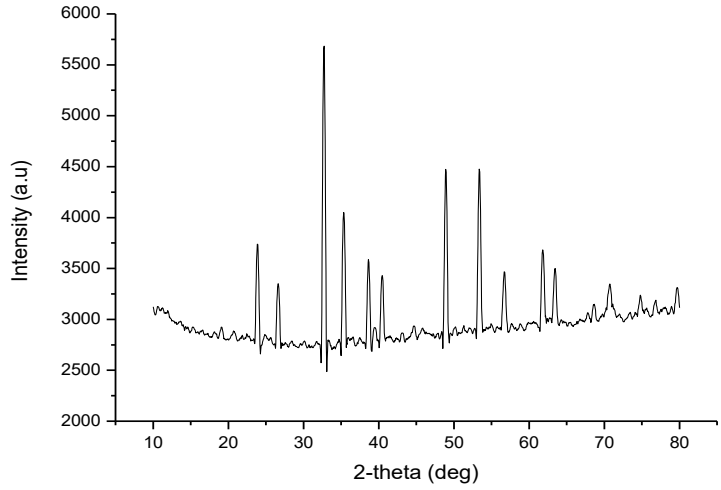
Karakterisasi X-Ray Difraktometer (XRD)



(a)



(b)



(c)

Figure 3.1 XRD spectrum pattern (a) sample A; (b) sample B; (c) sample C

XRD specturm provides particle size information from crystallization degree. The spectrum shows that peak 311 have 2θ diffraction angle which leads to the difference of particle size. The analysis of nanoparticle ironsands is shown below..

Table 3.1 **Analysis of nanoparticle ironsands**

Name	**k**	**θ**	**λ(nm)**	**FWHM**	**Particle size (nm)**
Sample A	0.89	16.3746	0.15406	0.2961	33.76
Sample B	0.89	16.3746	0.15406	0.8392	11.84
Sample C	0.89	16.364	0.15406	0.8399	11.14
Sample D	0.89	24.4843	0.15406	0.22859	43.12
Sample E	0.89	16.3648	0.15406	0.89031	11.14
Sample F	0.89	24.5276	0.15406	0.8438	11.32

The analysis shows that the higher temperature yields the smaller particle size. Meanwhile, the longer stirring time applied yields the smaller particle size. Mineral content analysis conclude that Bekri ironsands of Lampung Tengah is dominated by Ilmenite (Fe Ti O_3) and Potassium Chloride (K Cl).

4. Conclusion

The research has successfully synthesized iron sands with base precipitation method. On the higher temperature and the longer stirring time, will yields the smaller particle size. Mineral content of ironsands in Lampung Tengah are dominated by Ilmenite and Potassium Chloride.

5. Acknowledgment

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