Utilization of Bagasse Fly Ash to Remove the Unpleasant Odor of Stevia Extract and Soy Milk

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Abstract. Stevia is a safe natural sweetener that, but has a slightly unpleasant odor. Soy milk is undoubtedly high nutritional value, soy milk slightly unpleasant odor. Bagasse Fly Ash (BFA) is a sugar factory waste which is abundant, not widely used yet, and allowed to accumulate around the sugar factory. BFA can be activated with a solution of NaOH become adsorbent. Utilization of activated BFA to remove the odor of stevia extract and soy milk means the utilization of a waste to reduce other waste. Deodorizing done by batch system. Before being used as adsorbent, BFA characterized using SEM, XRD, FTIR, and AAS. Odor and color analysis conducted by organoleptic. The results shown activation increases the cavity, BFA containing SiO₂ and Al₂O₃, does not contain Pb, Cr, Cd. The results shown that the BFA can reduce odor of stevia from a scale of 4 to 2, the color becomes more clear, unpleasant odor of soy milk is also reduced.

1. Introduction

Stevia leaves contain stevioside and rebaudioside A, the level of sweetness up to 300 times that of sucrose, beneficial to health, because the calorie content is low, has an antioxidant, anti-fungal and non-carcinogenic. This plant comes from Paraguay that has spread to several countries in Asia, Europe and Canada, cultivation of commercially in Karanganyar- Tawangmangu Central Java [1]. Stevia also developed in Cibodas, from the area of 1 hectare (population 40,000 plants), generated from 3.6 to 7.2 tons of dry stevia leaves. This amount is far higher than the productivity of other varieties of stevia which is only 3-6 tons per year at a price of dry stevia reached Rp 25,000 per kg [2]. Stevia extract from stevia leaf powder can be done by methanol, ethanol or water, 20 grams of powdered leaves stevia with 200 ml of methanol was obtained 0.2985 grams of stevia crystals [3]. The problem to consume stevia is the stevia extract has a slightly unpleasant smell.

Soy milk is a high nutritional beverage, rich of protein and vitamin. Similar with stevia, this milk has a rotten unpleasant smell. To overcome the problems there are two manner to reduce the odor, first use an adsorbent, second mask the odor by essence. For the first manner, we must choose an adsorbent that is cheap and abundant. Fl y ash known as bagasse Bagasse Fly Ash (BFA) is a sugar mill waste that has not been widely used, is available in abundance, which can be activated into adsorbent can be selected. Abundane of bagasse in Indonesia is quite large. Increasing production of cane in 1999 totaled 2,270,623 tons, thus bagasse produced ranged from 340 593 tonnes to 711 614 tonnes [4]. One of Sugar Industry Kremboong can grind 2,700 tons of cane per day, every hour produces 2.8 tons of bagasse, in one year can reach 5103 tons. Indonesia has many sugar industries spread in Java, Sumatra and Sulawesi, so availability of bagasse is very much.
Regarding the effectiveness of the BFA as absorbents have been studied, including disappearances cadmium and nickel from waste water using bagasse fly ash, equilibrium adsorption is affected by the initial pH (pH0) of the solution. The pH0 ≈ 6.0 is found to be the optimum for the individual removal of Cd(II) and Ni(II) ions by BFA. The pH of the system, however, increases during the initial sorption process for about 20 min and, thereafter, it remains constant. The equilibrium adsorption data were obtained at different initial concentrations (C0 = 10−100 mg/l), 5 h contact time, 30 °C temperature, BFA dosage of 10 mg/l at pH0 6. Desorption with various solvents showed that the hydrochloric acid is the best solvent; the maximum elution being about 65% for Cd(II) and about 42% for Ni(II). [5] Removal by adsorption of phenol from synthetic aqueous solutions by bagasse fly ash (BFA) was investigated at 303 K under dynamic conditions in a packed bed. The effects of sorbent bed length (Z = 40–90 cm), flow rate (Q = 0.01–0.04 dm3/min), bed diameter (D = 2–4 cm), and initial concentration (C0 = 50–500 mg/dm3) on the sorption characteristics of phenol were investigated at an influent pH of 6.5. More than 99.5% of phenol was removed in the column operated at C0 =100 mg/dm3 of phenol. The column performance improved with increasing Z and decreasing Q. The sorptive capacity of BFA for phenol was found to be 9.93 mg/g [6] brown color of stevia extract contain tannin can be removed by activated carbon under optimum condition using 200°C of temperature and using 6 of pH operation. Concentration of tannin measure by spectrophotometer using 725 nm of wavelength.

Study examines the adsorption of pyridine (Py) from aqueous solutions, using BFA as an adsorbent have been performed to evaluate the influence of various parameters, such as initial pH (pH0), adsorbent dose (m), contact time (t), initial concentration (C0), and temperature (T), on the removal of Py from the aqueous solutions, batch adsorption studies. The maximum removal of Py is determined to be 99% at lower concentrations (<50 mg dm−3) and 95% at higher concentrations (600 mg dm−3), using a BFA dosage of 25 kg m−3 at normal temperature. The desorption of Py from Py-loaded BFA with several solvents shows that only 68.70% and 51% of Py could be recovered, using ethyl alcohol and 0.1 N H2SO4, respectively [8].

The adsorption of 2-picoline from aqueous solutions onto bagasse fly ash (BFA) have been studied. The influence of various parameters like initial pH (pH), adsorbent dose (m), contact time (t), initial concentration (C0) and temperature (T) on the adsorption of 2-picoline from the aqueous solutions were studied using batch adsorption experiments. The maximum removal of 2-picoline is found to be 98% at lower concentrations (<50 mg dm−3) and 49% at higher concentrations (600 mg dm−3) using 5 kg m−3 of BFA dosage at normal temperature and natural pH0 (~6.5) [9]. Base on the capacity of BFA to adsorb some chemical compound, BFA bill try to remove unpleasant odor in Stevia extract and soy milk.

2. Methodology
2.1. Activation and characterization:
Equipments required: Oven, Reflux apparatus, SEM, XRD, FTIR. Materials: Bagasse Fly Ash, NaOH. Procedure: (a) washing and drying the BFA, (b) do reflux BFA with a solution of NaOH 2.5 M at a temperature of 100 °C for 3 hours (c) washing the BFA to neutral and drying, (d) characterization BFA with SEM, XRD and FTIR,

2.2. Removing unpleasant odor from Stevia extract:
Equipments required: Hotplate, filter paper whatman 42, shaker. Material: activated BFA, stevia leaf, aquadest. Procedure: (a) Extract 1g of stevia leaf by with 100 mL hot water of distilled water. (b) when cool add 1g of BFA, shake for 0.5 hour, (c) filter with whatman 42. Do organoleptic test against the filtated stevia before and after added BFA

2.3. Removing unpleasant odor of Soy milk:
Equipment required: Hope plate, beaker glass, blender and shaker. Materials: soy bean, aquadest, activated BFA. Procedure: (a) soak 1kg of white Soybean Overnight with 500 mL of aquadest (b)
boiled for 1 hour, (c) lend until smooth, (c) Filter with a clean cloth, to produce Soy Milk (d) take 100 ml of Soy Milk, (e) Add 1 g of BFA, filter with Whatman 42. (f) DO organoleptic test against the filtrate before and after added BFA.

3. Result and Discussion
Activation make expanding pore, shown by SEM data figure 1. Activation also reduce crystallinity of BFA.

![Figure 1. SEM image of BFA before and after activation](image)

Main ingredients BFA is SiO$_2$ and Al$_2$O$_3$, as shown in figure 2. There are peaks characteristic of SiO$_2$ on the value of 2θ = 26.77°, 20.95° and 50.46° corresponding to the standard JCPDS No.88-2302. Al$_2$O$_3$ peaks characteristic at 2θ = 34.74°, 42.58°, and 64.22° according to the standard (JCPDS No. 88-0107). The activation process caused crystallinity of BFA is reduced and more amorph, that mean increasing the capacity of absorption.

![Figure 2. XRD data of BFA](image)

FTIR Data provides their information some functional groups, that may form a chemical bonds, beside to van der Waals bond as shown in figure 3. BFA reduce unpleasant odor of stevia from a scale of 4 to 2, the color becomes more clear, unpleasant odor of soy milk is also reduced

4. Conclusion
Bagasse Fly Ash (BFA) effective to eliminate odor and color of stevia extract. BFA reduce odor of Soybean Milk.
Recommendation
Although BFA effective to reduce the color and odor of stevia extract and soy milk, but not immediately can be sugestion to use it, more need further study to ascertain whether the using of BFA as adsorbent meet the requirements of health drinks criteria.

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