Effect of White Charcoal on COD Reduction in Wastewater Treatment

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Abstract. The objective of this study is to compare the COD reduction in wastewater between using coconut shell and coconut spathe white charcoal from Khlong Wat NongPra-Ong, Krathumbaen, SamutSakhon province, Thailand. The waste water samples were collected using composite sampling method. The experimental section can be divided into 2 parts. The first part was study the optimum of COD adsorption time using both white charcoals. The second part was study the optimum amount of white charcoal for chemical oxygen demand (COD) reduction. The pre-treatment of wastewater was examined in parameters include temperature, alkalinity (pH), conductivity, turbidity, suspended solid (SS), total dissolved solid (TDS), and COD. The results show that both white charcoals can reduce COD of wastewater. The pH of pre-treatment wastewater had pH 9 but post-treatment wastewaters using both white charcoals have pH 8. The COD of pre-treatment wastewater had COD as 258 mg/L but post-treatment wastewater using coconut shell white charcoal had COD steady at 40 mg/L in 30 min and the amount of white charcoals 4 g. The COD of post-treatment wastewater using coconut spathe white charcoal had COD steady at 71 mg/L in 30 min and the amount of white charcoals 4 g. Therefore comparison of COD reduction between coconut shell white charcoal versus coconut spathe white charcoal found that the coconut shell white charcoal had efficiency for COD reduction better than coconut spathe white charcoal.

1. Introduction

Water is crucial to the life of plants and animals. Living things on earth need to use and drink water. Especially, humans used water in consumption and in many activities such as fisheries, agriculture, industry, and transportation. In the past, the water is not pollution due to natural balance and it can be refresh itself because it has a small volume of rotation contamination from chemicals or pollutants. Despite, nowadays, when the growth of social community changes from the agricultural to industrial community, the water pollution is one big problem to solve because natural could not refresh itself instantly. There are four main techniques to treat wastewater that will depend on how the appropriate use of wastewater includes chemical process, biological process, physical process and physical-chemical process. The chemical process is a way to treat wastewater by separating different substances or contaminants in treated water. The contaminated by adding various chemicals to react, however, this method has limitation because when adding chemicals to the wastewater which impact on the environment and high costs for chemicals [1-4]. The biological process is the principle of using microorganisms to decompose the organic material changed to carbon dioxide and ammonia. The
limitation of this process is selection of aerobic bacteria or anaerobic bacteria suitable for wastewater [5-8]. The physical process is a simple wastewater treatment that separates insoluble solids. The disadvantage of this technique is the cost of expensive equipment for separation. There are many different methods of separation such as screening, skimming and trapping [9-10]. The physical-chemical process have two ways; carbon adsorption method uses charcoal powder or carbon as a substance adsorbent, and ion exchange is based on the principle of exchange of charge between pollutants in wastewater with medium containing both positive and negative charges. This is an economical way because natural materials readily available [11-14]. Therefore, in this work, the wastewater from Khlong Wat NongPra-Ong, the surface wastewater, from community in SamutSakhon province, was a source of water samples. All samples were treated with white charcoal from coconut shells and coconut spathe for applying on wastewater treatment in the surface water source in the future.

2. Materials and Methods
Coconut shell and coconut spathe is the wastes were collected from the fresh market in Prachinburi province. Coconut shell and coconut spathe were burned at more than 1000 °C for change to white charcoal. Then, both white charcoal were grinded and used as adsorbent for adsorption of COD. This experiment can be divided into two parts. The first part was study adsorption time of 2 g white charcoal for COD reduction at 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 min. The second part was study the optimum amount of white charcoal 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 g for COD reduction.

3. Results and Discussion

3.1 Pre-treatment water properties
Water properties of pre-treatment water sample were observed and measured included colour, odour, temperature, pH, conductivity, turbidity, SS and TDS. The results show that pH as 9, conductivity as 947 µS/L, turbidity as 28.03 NTU, SS as 158.72 mg/L, TDS as 472 mg/L, and COD as 258 mg/L.

3.2 Study adsorption time and the optimum amount of white charcoal for COD reduction
The adsorption time were studied at 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 min, and using 2 g of white charcoal per water sample 100 mL for COD reduction. The adsorptions of COD were measured using spectrophotometer. The results show that the best adsorption times were steady at 30 min in both white charcoals follow as Figure 1(a). These results may cause by limitation of pore volume and specific surface area of white charcoals [15]. The COD of pre-treatment sample was 258 mg/L. The results indicated that the coconut shell white charcoal can reduce the COD of wastewater from 258 mg/L to 40 mg/L in adsorption time at 30 min, while the coconut spathe can reduce the COD of wastewater from 258 mg/L to 74 mg/L in adsorption time at 30 min. It is cleared that the coconut shell white charcoal can reduce COD better than the coconut spathe white charcoal. The optimum amount of white charcoal for COD reduction were studied using spectrophotometer at adsorption time 30 min, and various the amount of white charcoals as 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 g in 100 mL wastewater. Figure 1(b) show of study the optimum amount of both white charcoal were 4 gand indicated that coconut shell white charcoal can reduce the COD from 258 mg/L to 19 mg/L while coconut spathe can reduce the COD from 258 mg/L to 71 mg/L. These results were related with previous report [16]. It is confirmed that the coconut shell white charcoal can reduce COD better than the coconut spathe white charcoal the same amount of white charcoal.
3.3 Comparison of pre-treatment and post treatment wastewater with white charcoal
The pH of pre-treatment wastewater was 9 but pH of post-treatment as 8 in using both of white charcoal as shown in Figure 2(a). This is standard range of pH (7-9) of surface water follow Notification of the National Environmental Board No. 8 (BE 2537) issued under the National Environment Quality Promotion and Conservation Act, BE 2535 (1992), defining water quality standards in surface water sources (Category 3) of Thailand [17]. Figure 2(b) show the COD of pre-treatment wastewater as 258 mg/L, while post-treatment for 30 min using 4 g of coconut shell and 4 g of coconut spathe found that the COD of post-treatment with coconut shell and coconut spathe as 19 mg/L and 71 mg/L, respectively.

4. Summary
This work can be concluded that the saturated adsorption time of white charcoal was 30 min for using both of white charcoal from Prachinburi province. The optimum amount of both white charcoals for COD reduction of wastewater from Klong Wat NongPra-Ong, SamutSakhon province in Thailand was...
4 g. Both of white charcoals from coconut shell and coconut spathe can reduce the pH from 9 to 8. White charcoals 4 g can reduce the COD from 258 mg/L to 19 mg/L and 71 mg/L for using coconut shell and coconut spathe, respectively. In addition, both white charcoals not only reduce the COD, but reduce the colour and odour of wastewater also. It is clearly confirmed that the white charcoal from coconut shell can reduce COD better than from coconut spathe white charcoal and better than activated charcoal. The knowledge obtained from this study can be applied to the further treatment of wastewater in the actual surface water source.

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