CHAPTER V

CONCLUSION

5.1 Conclusion

The experimental results showed the possibility of the production of activated carbons with high surface area and adsorption capacity from used tires by carbonization and activation with superheated steam and carbon dioxide mixture. The carbonization results showed that the % yield and the volatile matter decreased while the % ash increased during the increase of temperature and time. The fixed carbon at 350°C was the maximum and it decreased when the temperature was raised to 500°C because some C-C bond in tires structure was broken, and because some carbon changed into oxide compound then it was removed from surface of particle. The optimum condition for carbonization was 500 g of used tires with the size of 5 x 5 x 5 mm at temperature 350°C for 60 min with air at a flow rate of 0.52 nl/min. The char products obtained yield of 41.40 %, fixed carbon of 62.57 %, ash of 15.3 % and volatile matter of 22.13 %.

The chars obtained from carbonization were then activated with carbon dioxide and superheated steam. The results showed that the increase of temperature and time resulted in better activation. However, at higher temperature, the decrease in micropore was observed, which was due to coalescence or widening of already formed pores. The activated carbon from chars in medium size (0.60-1.18 mm) had the highest adsorption capacity and surface area. When the flow rate of carbon dioxide increased, the adsorption capacity and surface area decreased. The optimum condition for activation was 200 g of carbonized chars with size of 0.60 - 1.18 mm at 900°C for 45 min with air at a flow rate of 0.27 nl/min, CO_2 at a flow rate of 2.0 nl/min and

superheated steam. The resulting characteristics were yield of 27.99%, bulk density of 0.3590 g/cm^3, ash of 21.05 %, iodine number of 598.79 mg/g, methylene blue number of 247.08 mg/g, B.E.T. surface area of 658.75 m^2/g, micropore area of 424.27 m^2/g, external area of 234.48 m^2/g and average pore diameter of 22.24 Å.

It was concluded from the above experimental processes that used tires which most people consider as rubbish could be converted to activated carbon which is useful in industrial production. It also had been proved that carbon dioxide could be mixed with steam, instead of using only steam, in the activation process in order to minimize the cost of production.

In this globalization eva, recycling was one of the modern know-hows. Used tires and carbon dioxide had been recycled in this work to help solving the pollution problems to keep the atmosphere clean.

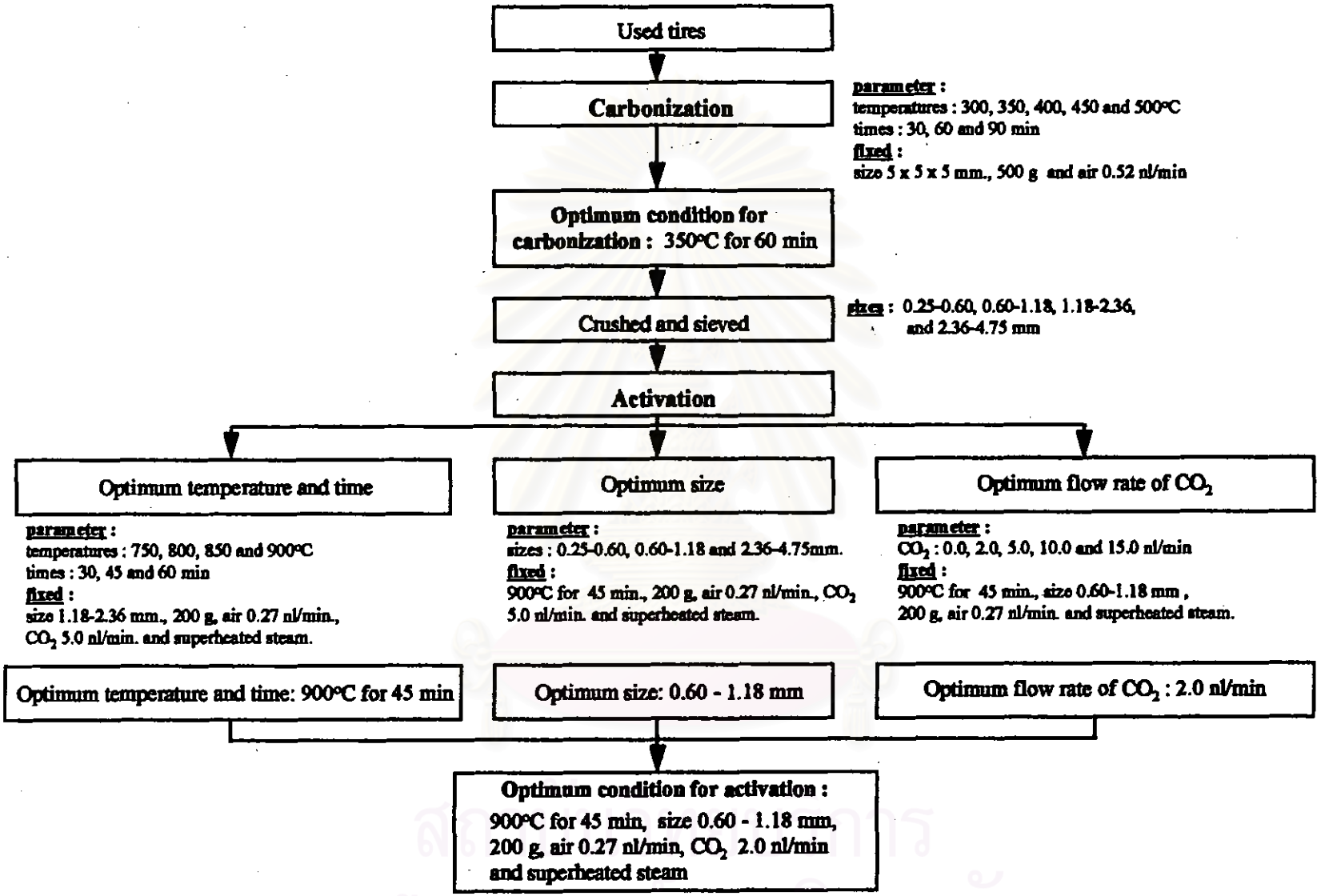

Figure 5.1 The optimum condition of the production of activated carbon from used tires by carbonized following by superheated steam and carbon dioxide activation in a fixed bed reactor.

5.2 Future works

1. By-products from carbonization such as tarry matter and volatile should be further studied for recycle or reuse.
2. Experiments on the adsorption of activated carbon for removal metal ions.
3. Investigation of flow rate of steam activation.
4. Study on the chemical activation.
5. Experiments on activation by using fluidization technique.