

# Preparation and Characteristics of Activated Carbon from Beech by CO<sub>2</sub> Activation

Ling Li<sup>1</sup>, Jeng-Yi Wu<sup>1</sup>, Euh-Jui Wang<sup>2</sup> and Ping-Szu Tsai<sup>1\*</sup>

## Abstract

The beech from Northern Europe exists less environmental pollutions. After the process of the carbonization and the vinegar collection, large amounts of carbonized beech were remained. However, these carbonized beech merely had low iodine value and specific surface area leading to less commercial value. In this paper, CO<sub>2</sub> activation was used to discuss the influence of the CO<sub>2</sub> flow rates, activating temperature and activating time on the yields, the iodine value and specific surface area of the activated carbons. Activated carbons with high specific surface area were expected to be produced. In addition, the activated carbon were analyzed by SEM and ICP-MS.

The experimental results showed that the yield of activated carbon decreases with increasing activating temperature and time at different CO<sub>2</sub> flow rates. In addition, the iodine value will increase with the increasing activating temperature and time. However, the iodine value decreased on the condition of excessive activating temperature. The maximum iodine value were 1195.17 mg/g.

## Experimental



## Results And Discussion

### Surface Morphology

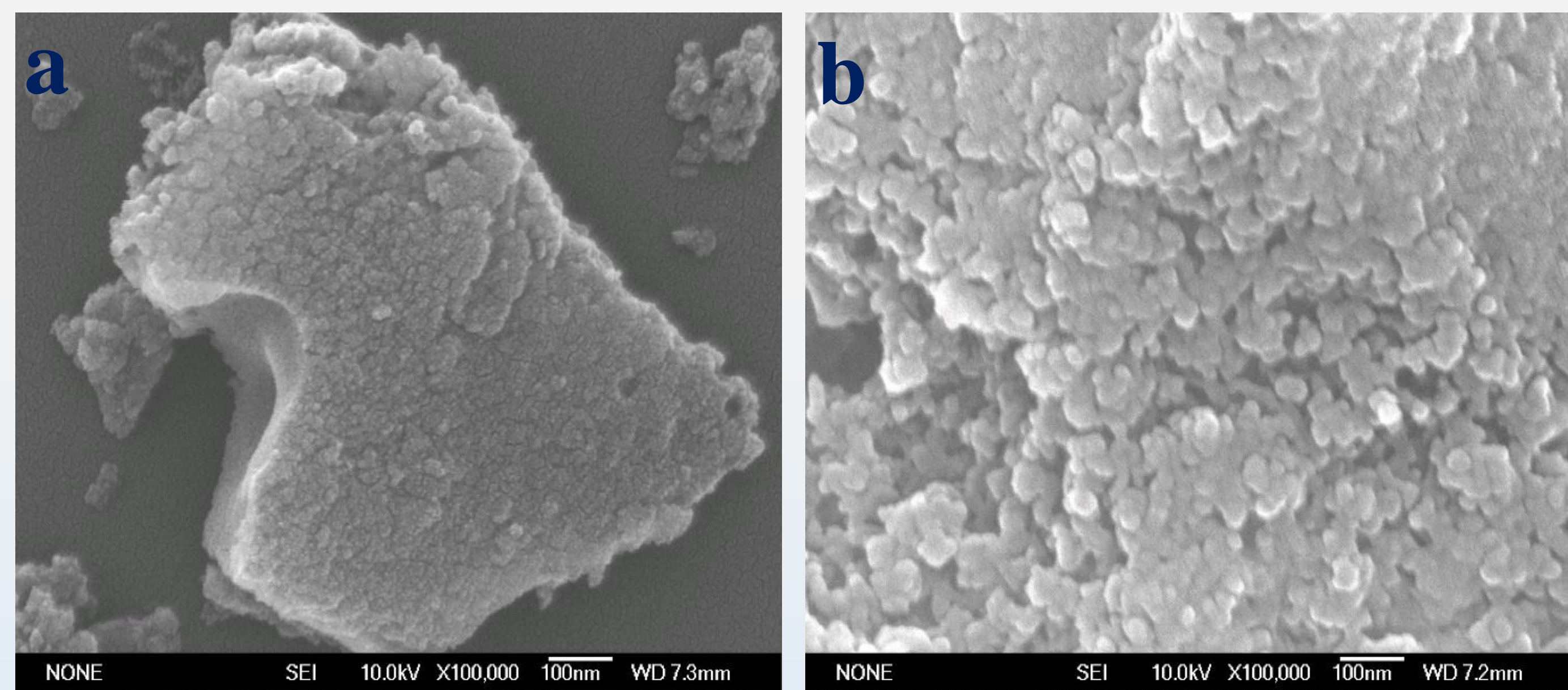


Fig. 1. Micrograph of the activated carbon at different activating temperature. (100,000 × SEM images) (a) 800°C; 200c.c.; 1hr, (b) 950°C; 200c.c.; 1hr.

- The SEM images showed that the surface morphology of beech activated carbon changed from smooth into porous structure with increasing activating temperature.

### Content of heavy metal

**Table 1**  
ICP-MS analysis results of beech and carbonized beech and activated carbon (950°C; 200c.c.; 1hr).

Heavy metal	Beech	Carbonized beech	Activated carbon	Detect limit	Standard values
Cd	ND	ND	ND	0.202	
Cr	ND	ND	ND	1.939	
Cu	1.57	2.84	4.76	0.601	<25
Ni	ND	1.99	4.07	1.073	
Pb	ND	ND	ND	1.134	<10
Zn	ND	8.64	ND	4.425	<25

- The ICP-MS data showed that the copper content of the activation carbon before and after activation were 1.57 ppm and 4.76 ppm, these value are both lower than that of pharmacopoeia standard of 25 ppm. In addition, lead and zinc were not detected on the whole experiment.

### Yield and Iodine value

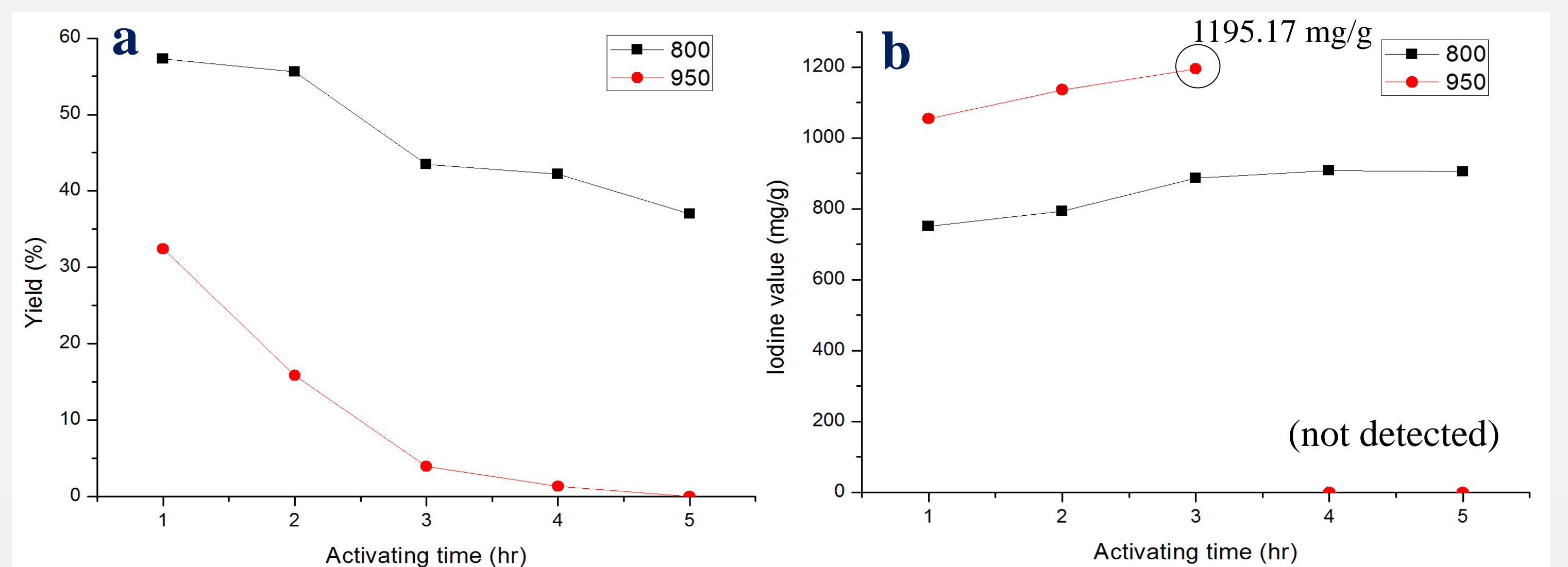


Fig. 2. Effects of activating time on the (a) yield and (b) iodine value of activated carbon (200c.c.).

- The yields of activated carbon decreases with increasing activating time. When the activating temperature is 950°C, the yields of the activated carbon approach zero on the condition of 4h activating time. The maximum iodine value were 1195.17 mg/g.

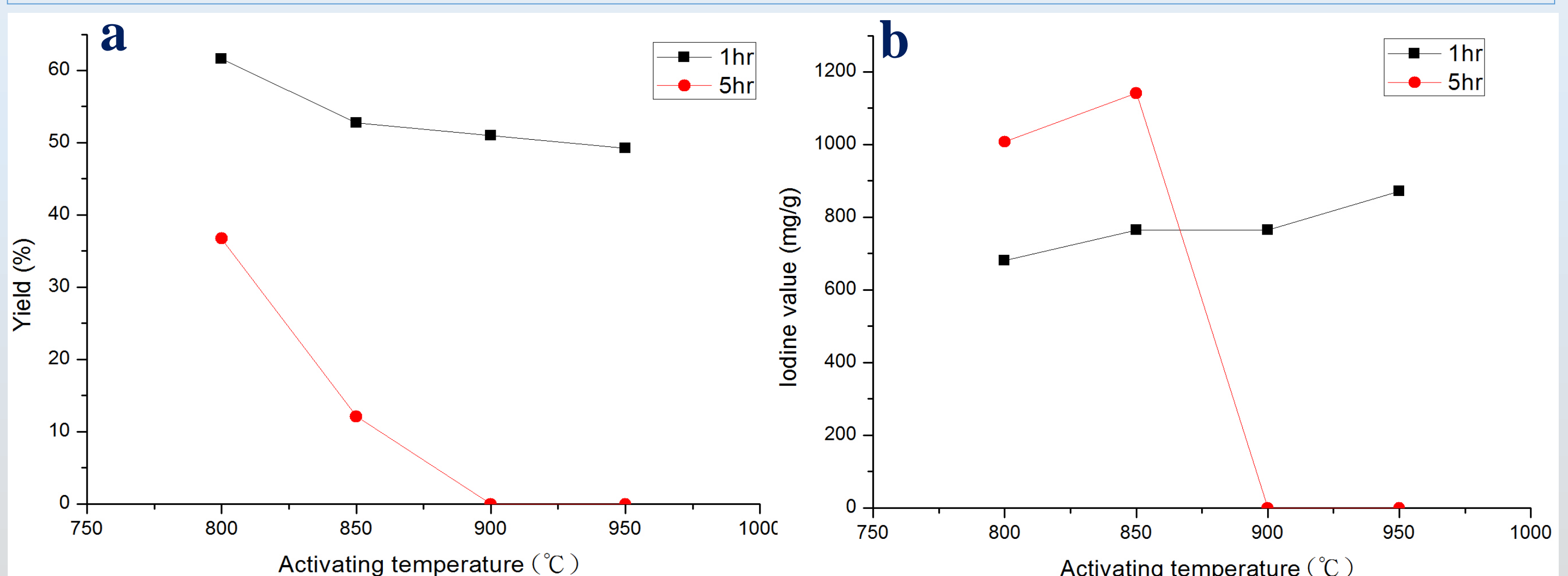


Fig. 3. Effects of activating temperature on the (a) yield and (b) iodine value of activated carbon (200c.c.).

- The yields of activated carbon decreases with increasing activating temperature. The iodine value decreased on the condition of exorbitant activating temperature.

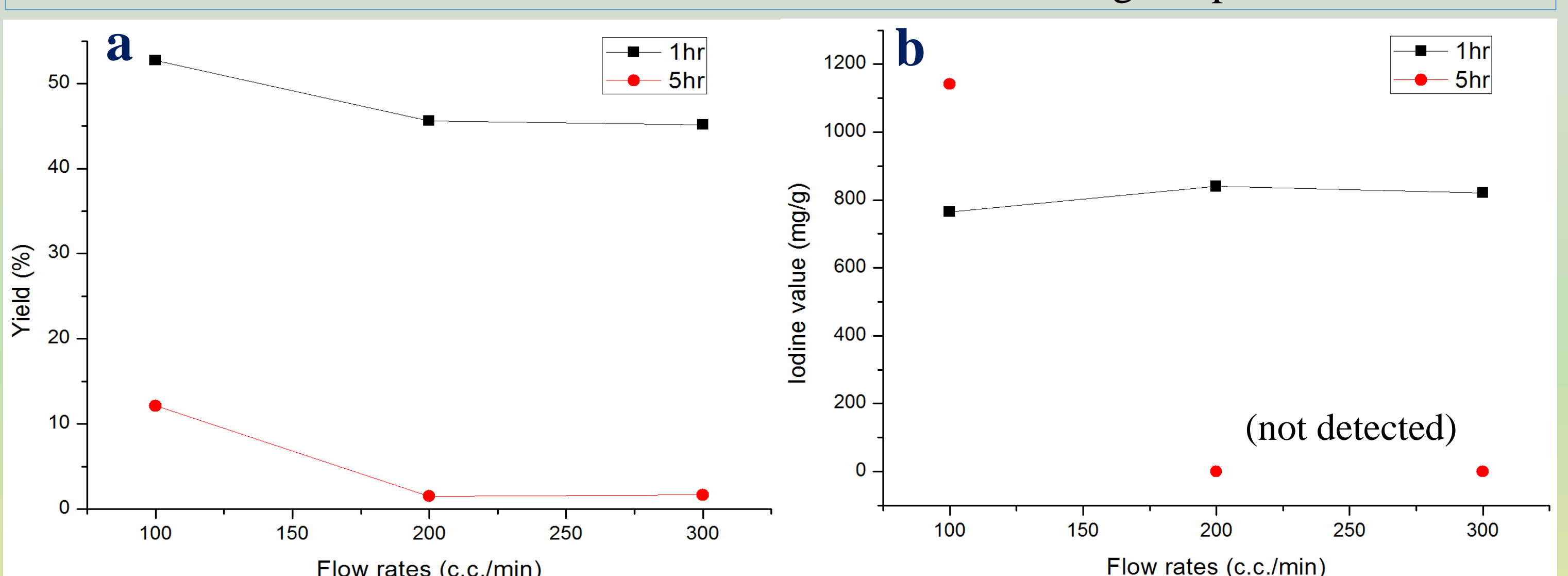


Fig. 4. Effects of CO<sub>2</sub> flow rates on the (a) yield and (b) iodine value of activated carbon (850°C).

- The yields of activated carbon decreases with increasing CO<sub>2</sub> flow rates. The iodine value of activated carbon increase with increasing CO<sub>2</sub> flow rates.