Study of Microwave Extraction Crude Polysaccharides and Triterpenoids from *Poria cocos* Soild-state Fermented Products

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06/01/2013 SCET

Outline

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Poria cocos

http://en.wikipedia.org/wiki/File:Tuckahoe.jpg

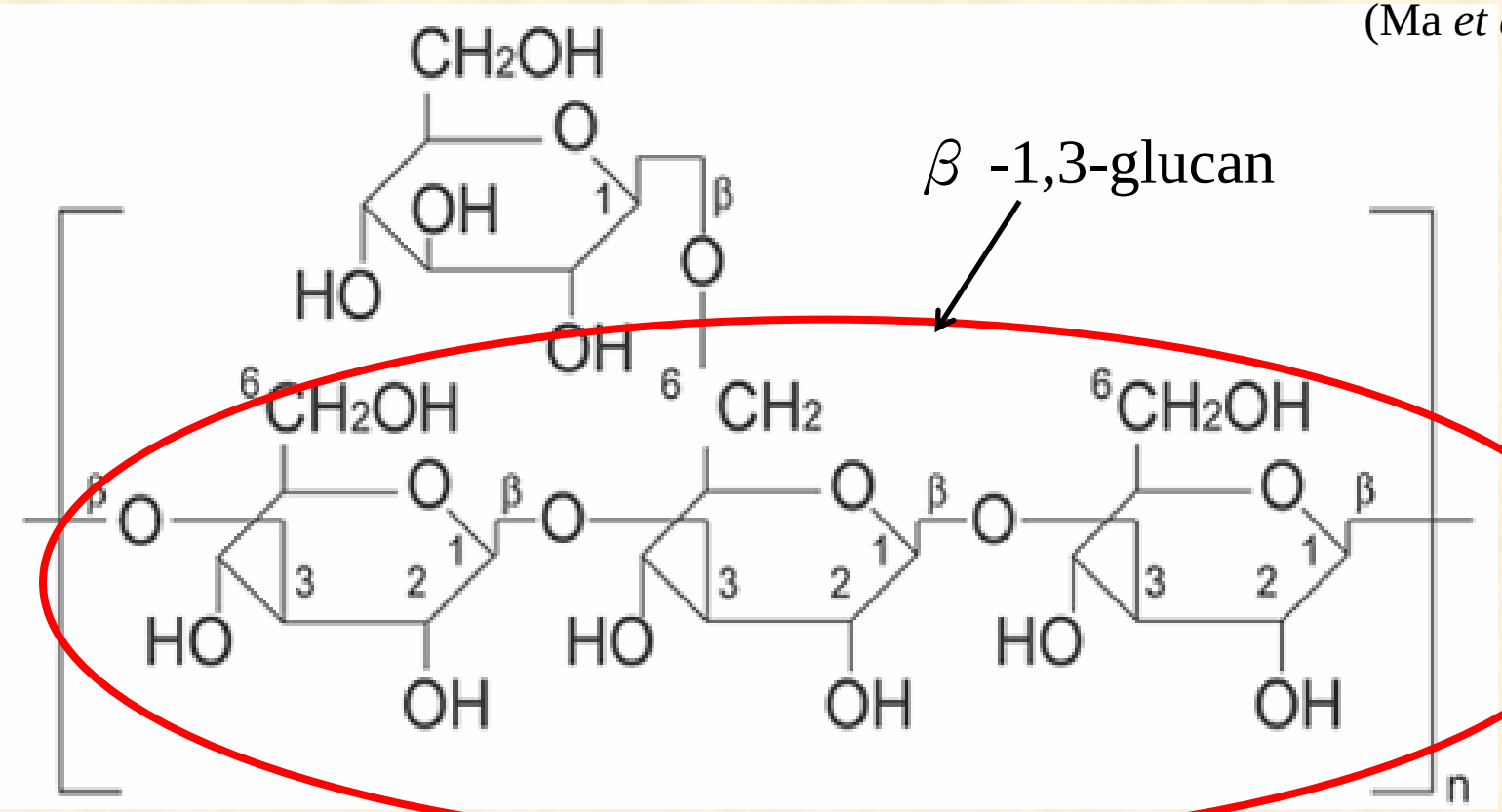
- A fungus grows on the roots of pine trees.
- The main bioactive compounds are polysaccharides and triterpenoids.
- It have bioactive functions are anti-inflammatory, antioxidant, immuno-modulatory, anti-tumor, diuretic, and hypoglycemic etc.

(Wang *et al*., 2009)

Polysaccharides

- Many bioactive polysaccharides have been isolated from mushrooms, fungi, yeast, algae, lichens, and plants.

(Ma *et al*., 2011)



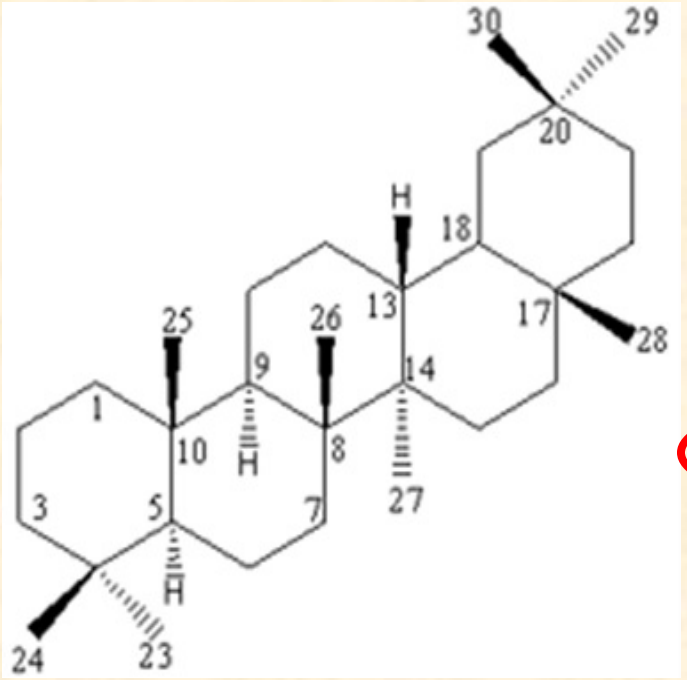
http://www.mycopharma.com

Bioactive functions of polysaccharides

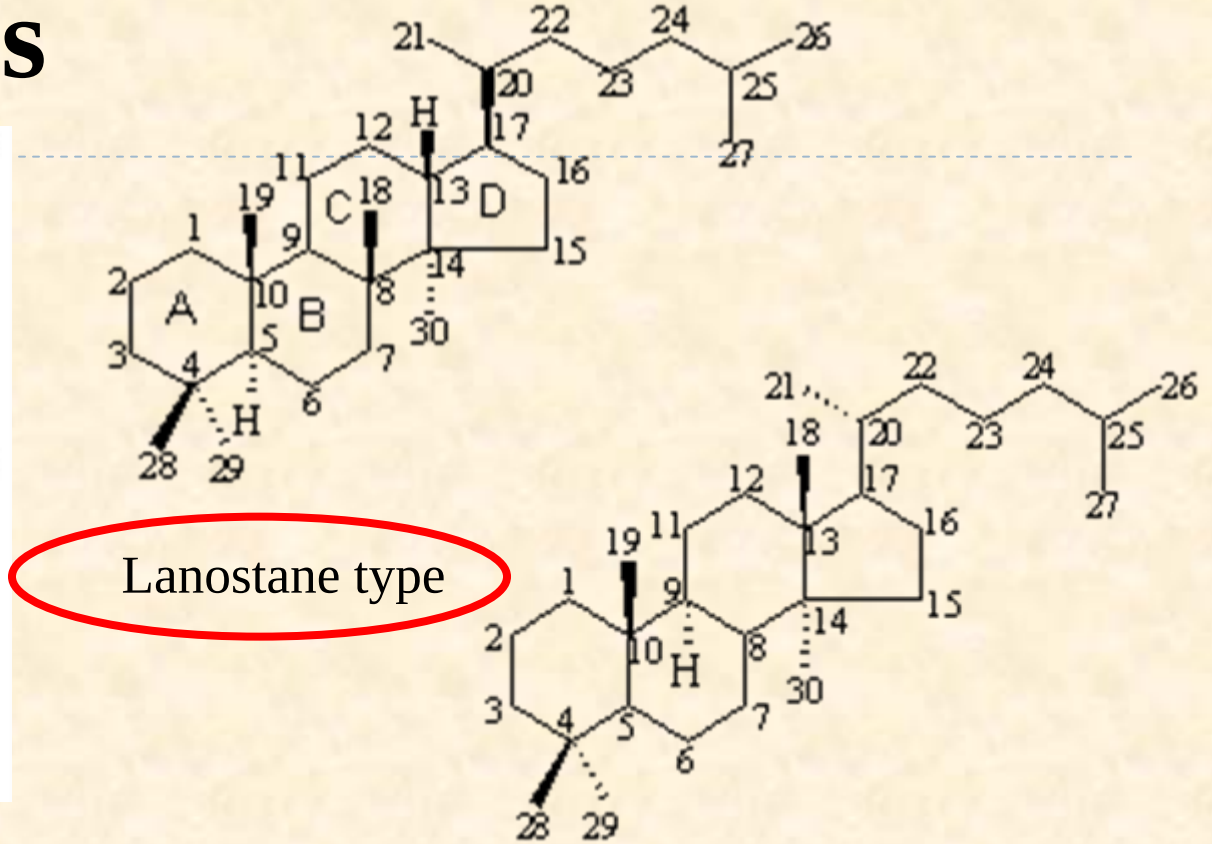
- Anti-tumor
- Anti-oxidation
- Anti-diabetic activity
- Immunity-modulation
- Anti-inflammatory

(Chen *et al*., 2010)

Triterpenoids



Oleanane type



Lanostane type

Dammarane type

http://210.27.80.89/2005/zhihua/file/wlkc/ch10_1.htm
http://dec3.jlu.edu.cn/webcourse/T000324/files/bjjx/bjjx2.2.html

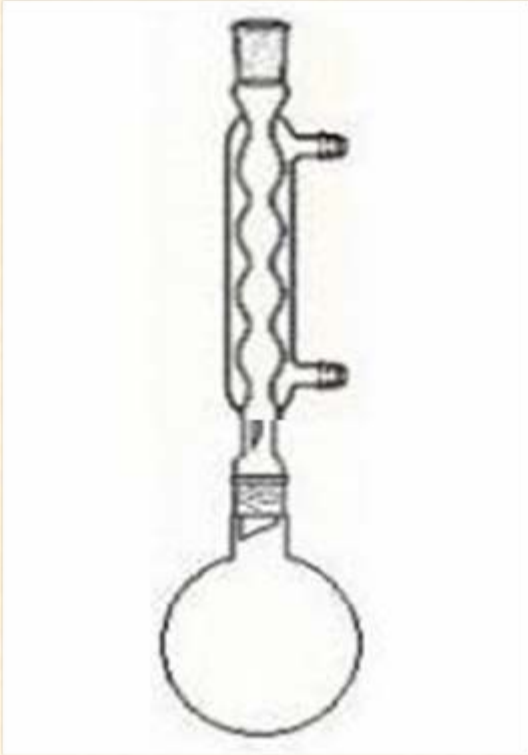
Bioactive functions of triterpenoids

- Hypolipidaemic
- Anti-atherosclerotic
- Anti-hypertensive
- Anti-microbial
- Anti-cancer
- Hepatoprotective
- Immunity-modulation

(Chen *et al*., 2007)

Extraction techniques

- Conventional extraction techniques
  - Heat reflux extraction (HRE)
  - Soxhlet extraction (SE)



(Kaufmann and Christen, 2002; Mandal *et al.*, 2007)

Extraction techniques

- Recent extraction techniques
  - **Ultrasonic-assisted extraction (UAE)**
  - **Microwave-assisted extraction (MAE)**
  - **Ultrasonic/microwave assisted extraction (UMAE)**
  - Supercritical fluids extraction (SFE)
  - Pressurized solvent extraction (PSE)

(Kaufmann and Christen, 2002; Mandal *et al.*, 2007)

Microwave (0.3~300 GHz)

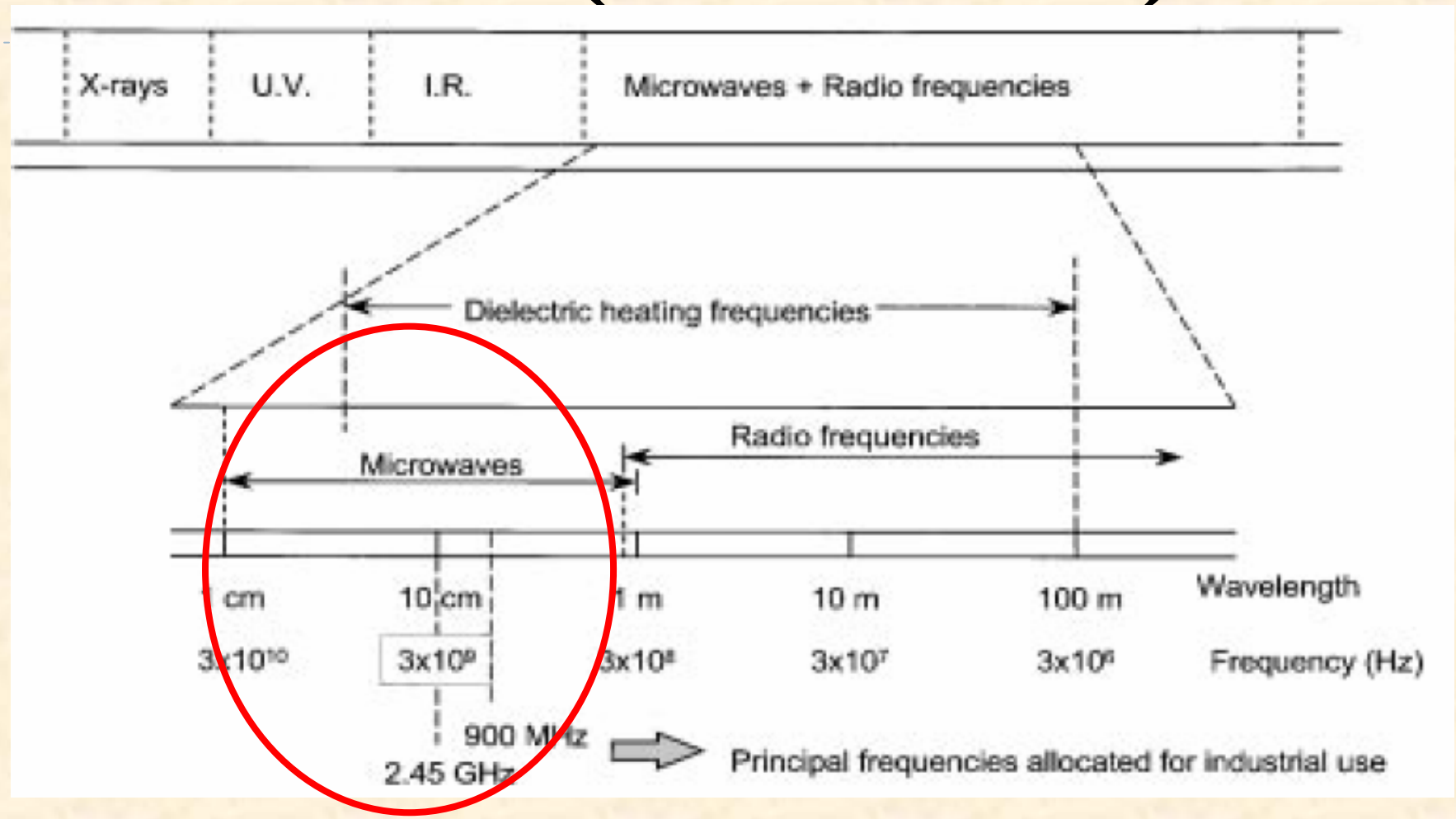


Fig. 1. The electromagnetic spectrum.

(Kaufmann and Christen, 2002)

Microwave extraction

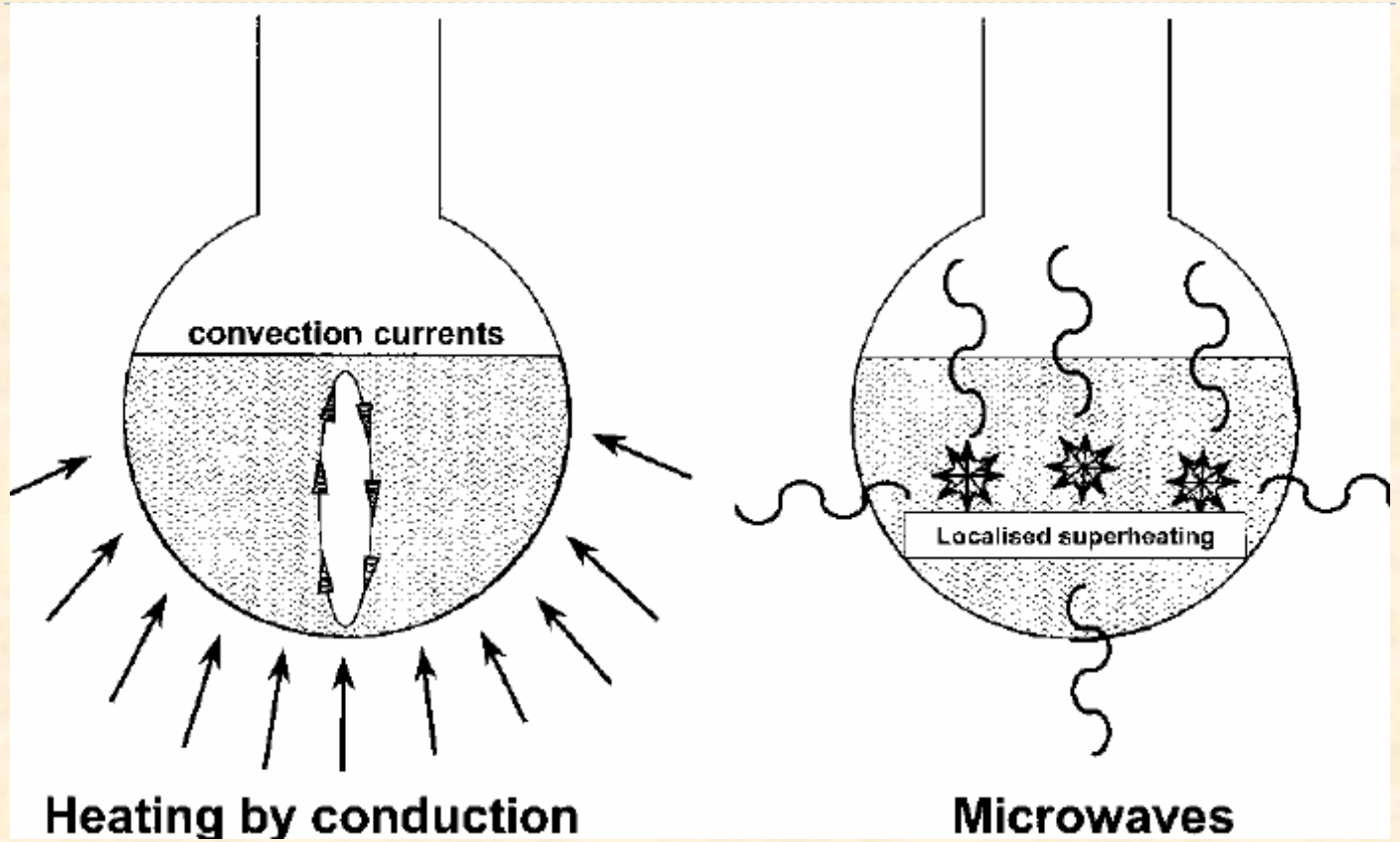


Fig. 2. Scheme of the heating principle by conduction in the classical method of extraction and by microwave irradiation in microwave-assisted extraction. (Kaufmann and Christen, 2002)

Table 1. Dielectric properties of some solvents commonly used in microwave extraction

Solvent	Dielectric constant (ε ')	Dielectric loss (ε '')
Acetone	20.7	
Acetonitrile	37.5	
Ethanol	24.3	6.08
Hexane	1.89	
Methanol	32.6	20.86
2-propanol	19.9	13.33
Water	78.3	12.29

$$P = K \cdot f E^2 \varepsilon''$$

P_D : power dissipation (W/cm^3)
E : electrical field strength (V/cm)
f : frequency (Hz)
ε '' : dielectric loss

(Mandal *et al.*, 2007)

Objectives

- To explore the microwave power, extraction time of the crude polysaccharides and triterpenoids content in the *Poria cocos* fermented products.

- To compare microwave extraction efficiency with hot water extraction and ultrasonic extraction.

Experimental design

- Preparation of Poria cocos fermented products

- Extraction of crude polysaccharides and triterpenoids in *Poria cocos* products

Poria solid-state fermented product

Inoculating *Poria cocos* (BCRC36022)

↓ pre-activation

Added 10 mL pre-activation broth

(**Wheat, soybeans, brown rice, barley, oats**)

↓

Cultivation for 7, 14, 21 and 28 days

↓

Sterilization at 121 ℃、60 min

↓

Hot-air drying

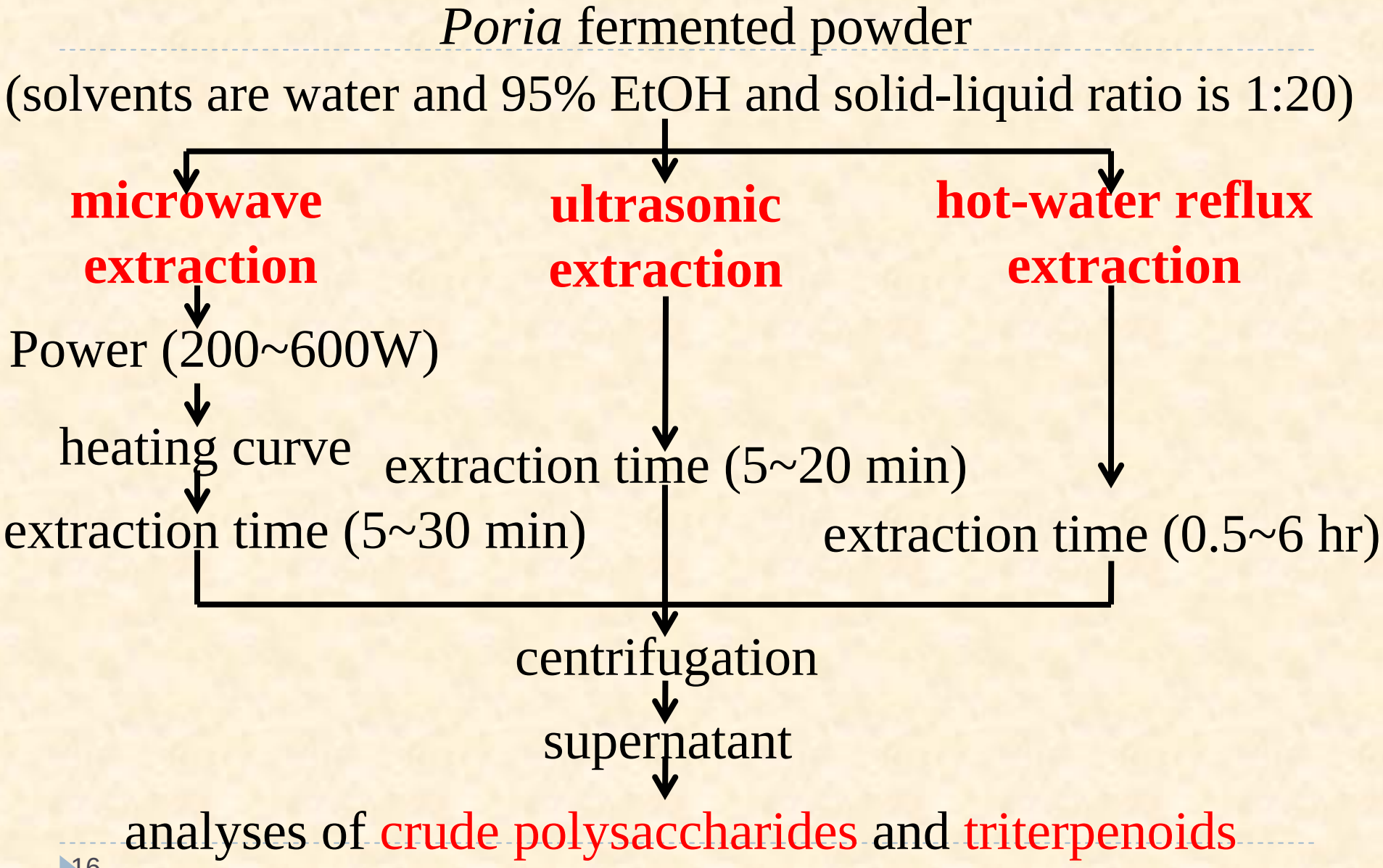
↓

Milling

↓

Fermented powder

Microwave extraction of *Poria cocos*



Results and discussion

Table 2. The contents of crude polysaccharides and crude triterpenoids in the *Poria cocos* solid-state fermented products using different cereal medium

Medium	Crud polysaccharide (%) from 2-weeks fermented products	Crude triterpenoid (mg/g) from 4-weeks fermented products
Soybean	5.16 ± 0.32^{d}	31.45 ± 0.09^{a}
Oat	11.21 ± 1.33^{c}	10.40 ± 0.65^{b}
Adlay	31.02 ± 0.22^{a}	7.67 ± 0.32^{c}
Brown rice	30.34 ± 2.44^{a}	2.62 ± 0.16^{d}
Wheat	25.13 ± 1.17^{b}	2.61 ± 0.19^{d}

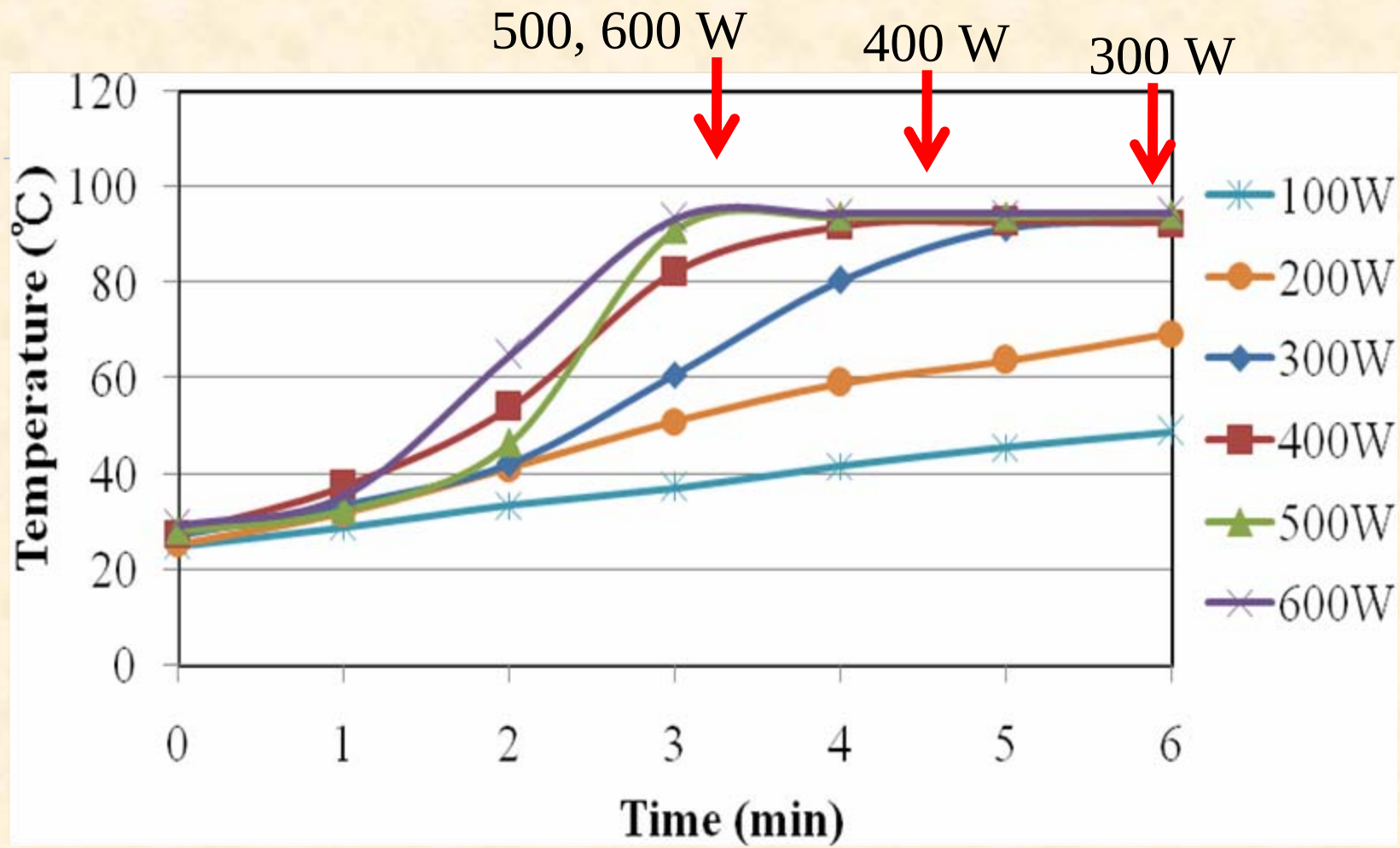


Fig. 3. Temperature-time history during microwave with different power for heating 50 mL water.

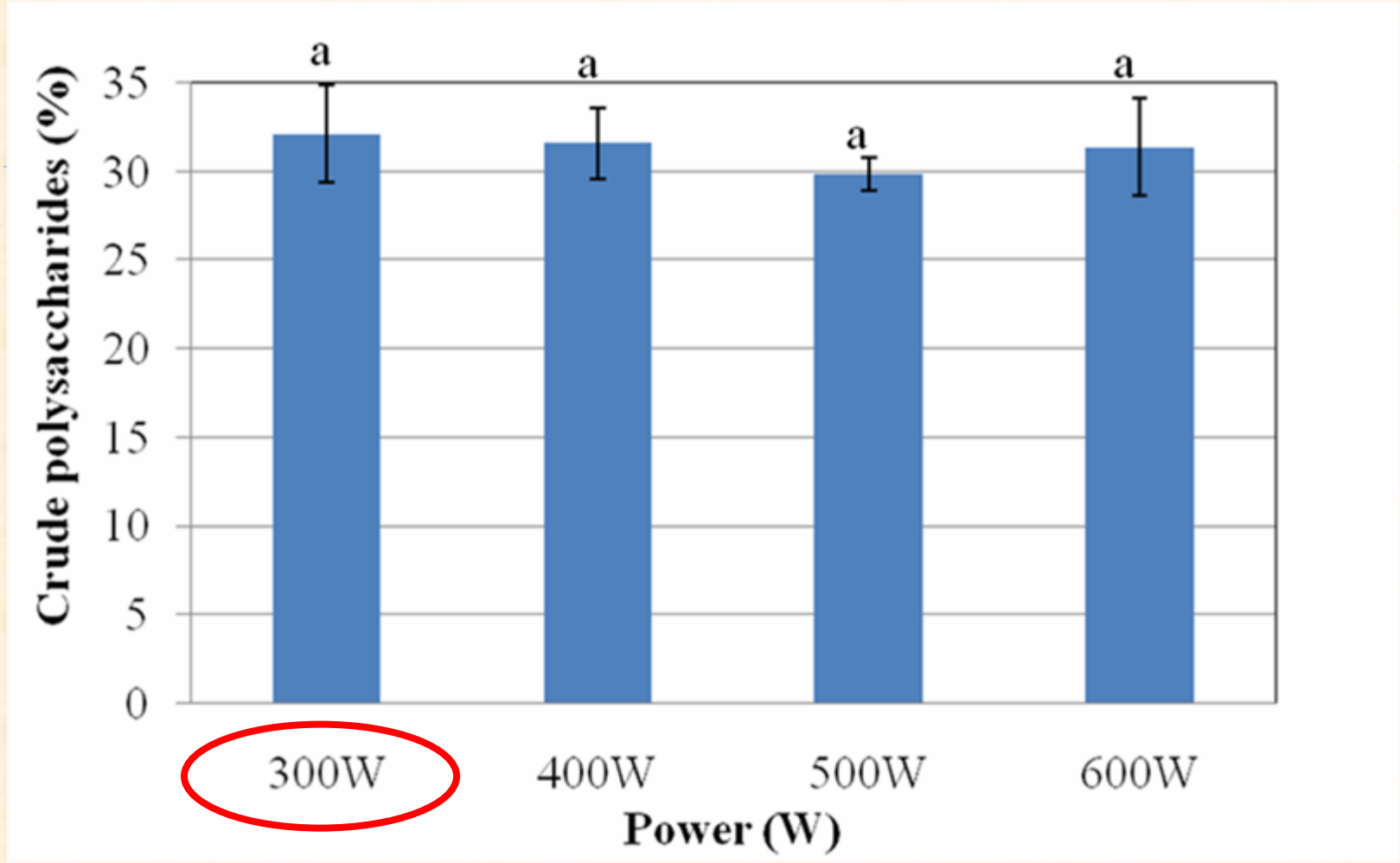


Fig. 4. Effect of different power on 10 min microwave extraction of crude polysaccharides from *Poria cocos* 14-day solid-state fermented adlay products.

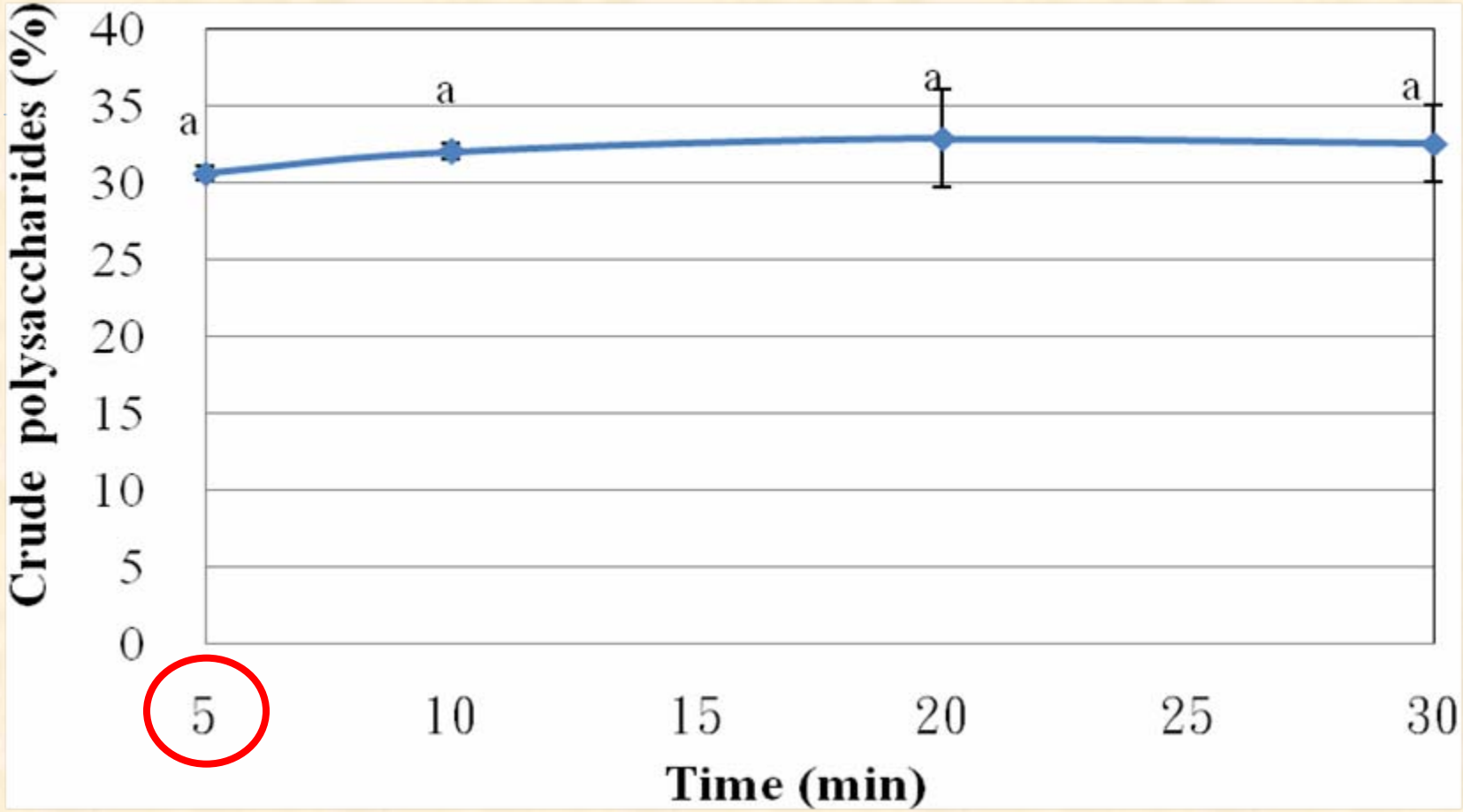


Fig. 5. Effect of extraction time on crude polysaccharides content from *Poria cocos* 14-day solid-state fermented adlay product by 300 W microwave extraction.

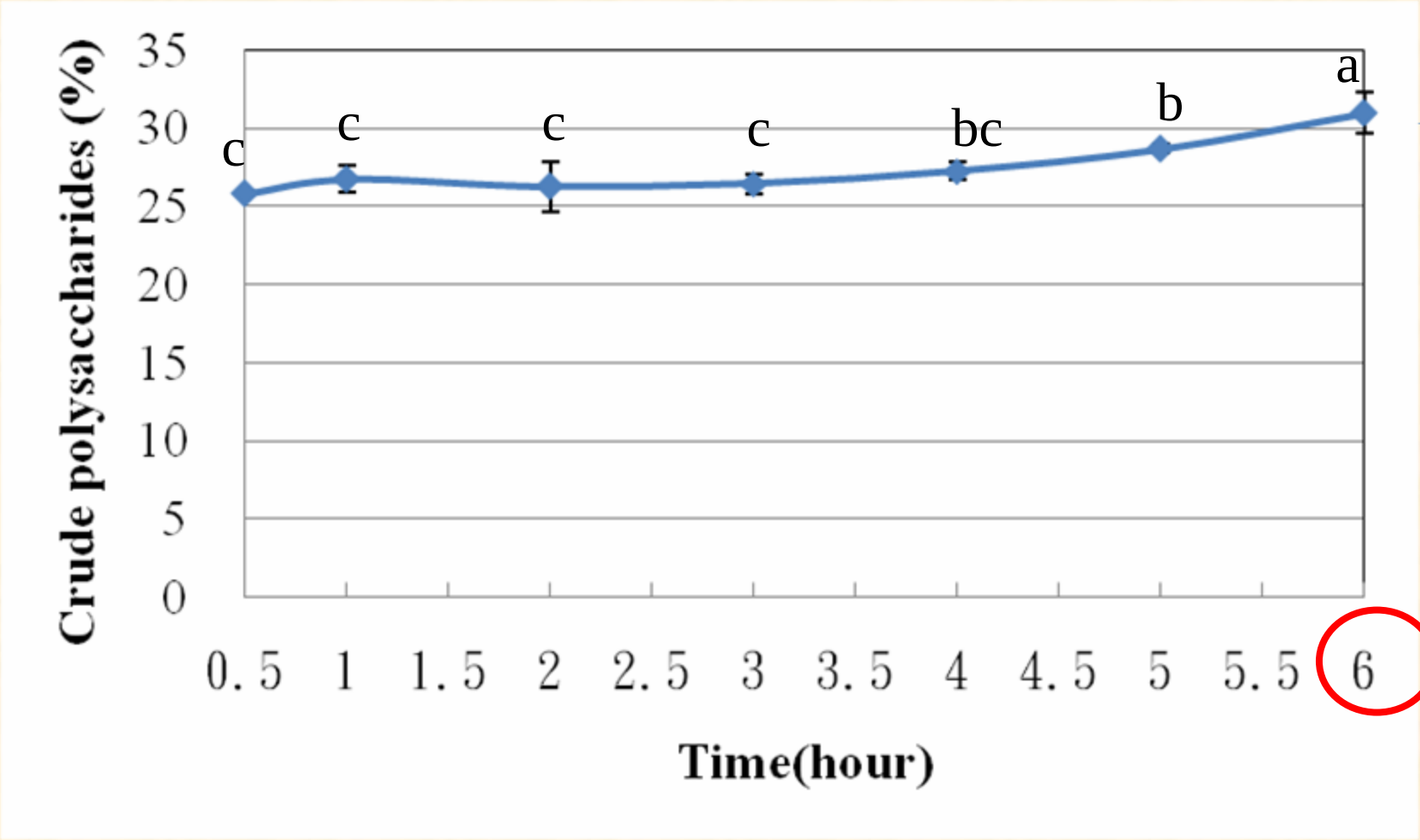


Fig. 6. Effect of extraction time on crude polysaccharides content from *Poria cocos* 14-day solid-state fermented adlay product by reflux with hot water.

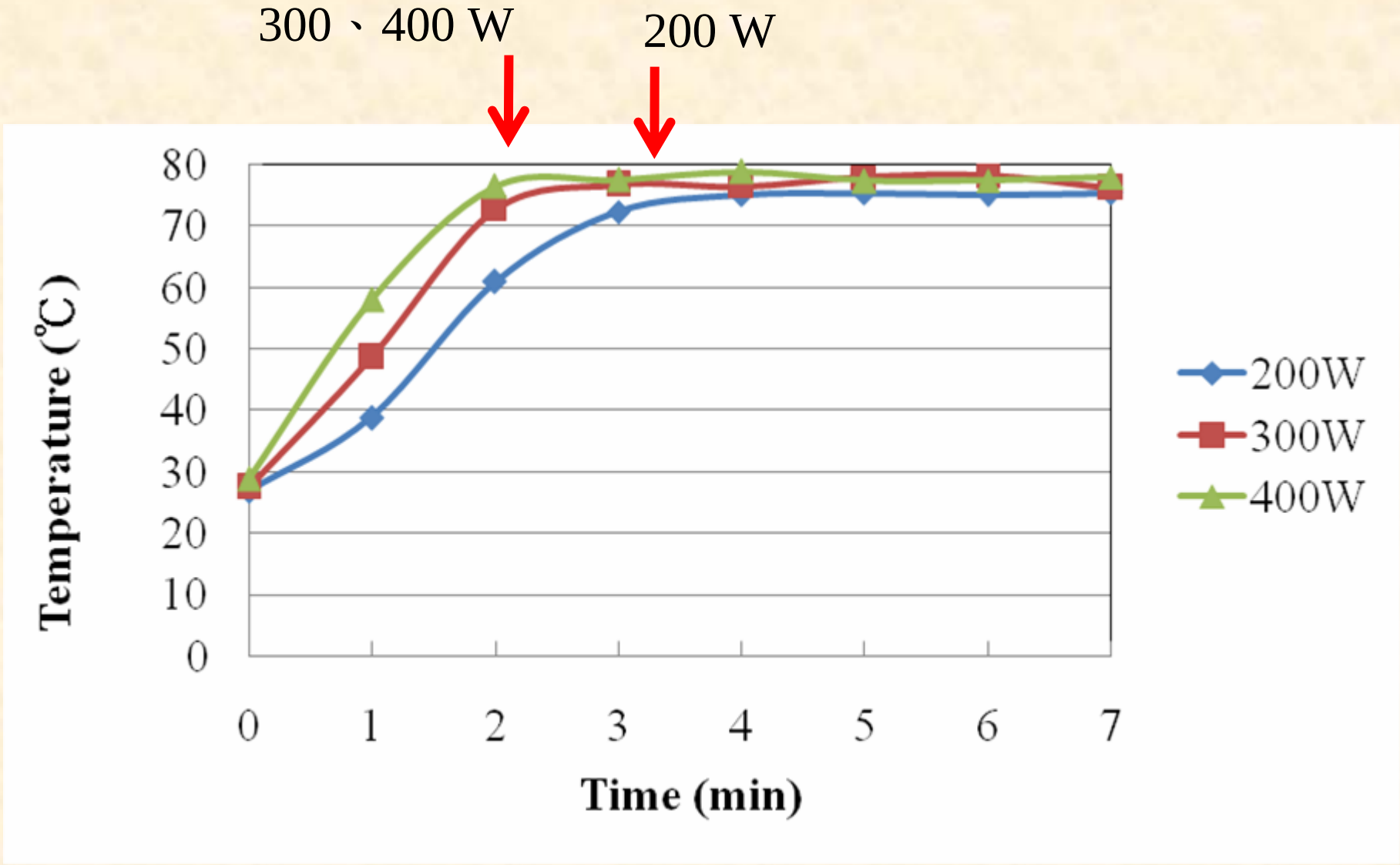


Fig. 7. Temperature-time history of 50 mL 95% ethanol by microwave heating with different power.

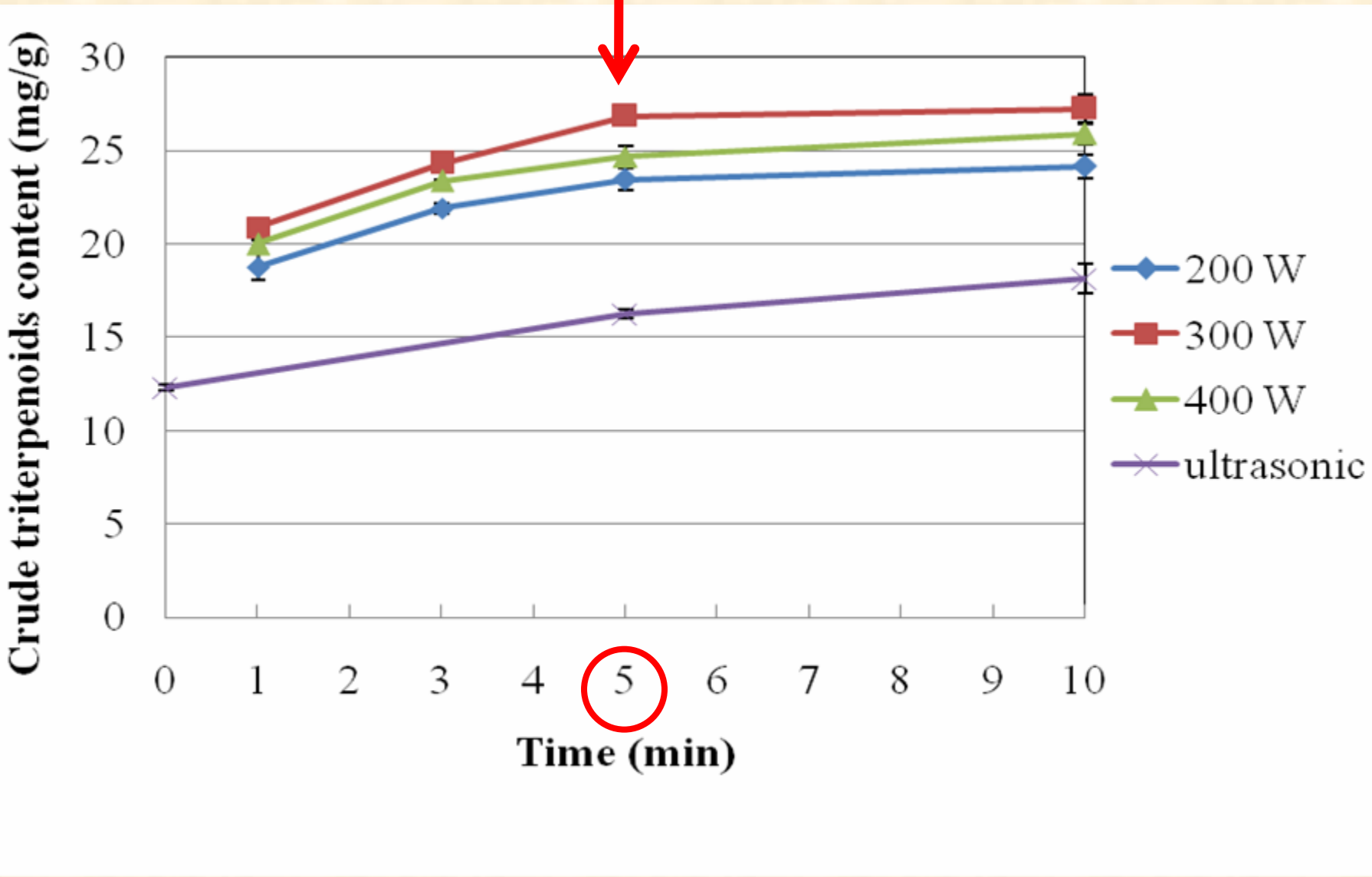


Fig. 8. Effect of different microwave power and extraction time and ultrasonic extraction time on the crude triterpenoids contents from *Poria cocos* fermented soybean.

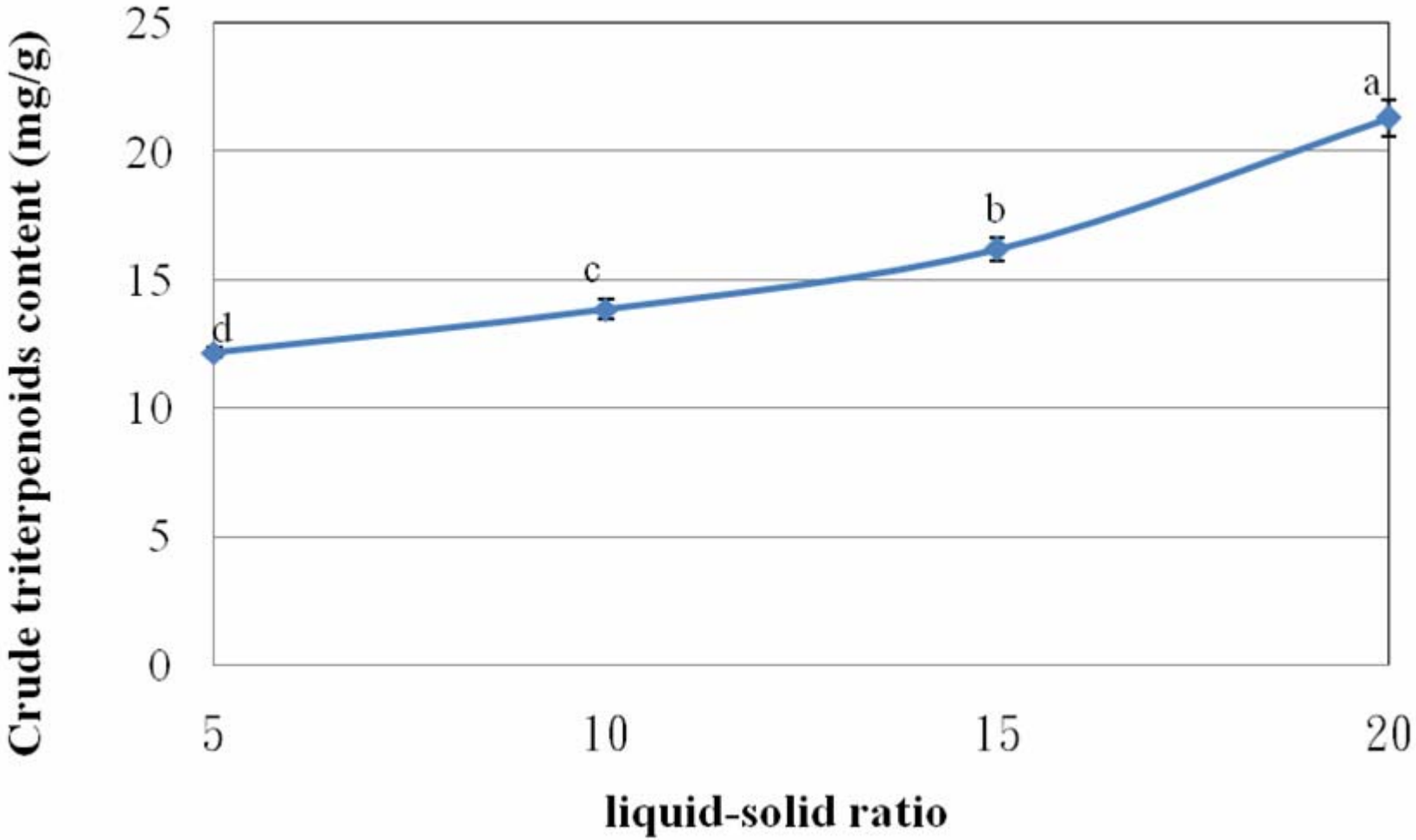


Fig. 9. Effect of different solid-liquid ratio on the extracted crude triterpenoids contents from *Poria cocos* fermented soybean by 300 W microwave.

Conclusions

- The highest crude polysaccharides and triterpenoids contents were in *Poria* fermented 2-week adlay and 4-week soybean, respectively.
- The solvents used for extracting crude polysaccharides and triterpenoids were water and 95% ethanol, respectively, and the solid-liquid ratio was 1:20.
- The optimal microwave extraction was controlled the microwave output power at 300 W heating for 5 min.

Thanks for your attention.