Asian Journal of Chemistry; Vol. 30, No. 2 (2018), 298-300

ASIAN JOURNAL OF CHEMISTRY

https://doi.org/10.14233/ajchem.2018.20907

# Extraction Temperature Effect in Modification of Nephelium Tannin Based Biosorbent

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*Received*: 3 July 2017; *Accepted*: 29 September 2017; *Published online*: 31 December 2017; AJC-18694

The effect of temperature on the extraction process of nephelium peel in the modification nephelium tannin based biosorbent (NTBB) from the nephelium peel was done by varying the temperature of the extraction. Modified nephelium tannin based biosorbent carried by the cross-linker using formaldehyde and performed stability of nephelium tannin based biosorbent by varying the pH system. The results of cross-link process between tannin extract and formaldehyde compounds to produce nephelium tannin based biosorbent which were characterized using infrared spectrophotometer. The characterization result by infrared spectrophotometer shown extraction temperature of tannin from the nephelium peel affected the formation of nephelium tannin based biosorbent functional groups. The higher extraction temperature cause HCN will be released and attached on nephelium tannin based biosorbent polymer that was detected by IR spectra. The stability of nephelium tannin based biosorbent in solution shows that nephelium tannin based biosorbent will easily dissolve in the system of high acidity so that it will form a high peak at a wavelength of 240-280 nm using a UV-visible spectrophotometer, where nephelium tannin based biosorbent optimum stability in solution occurs at pH 5.

**Keywords: Tannin, Nephelium, Extraction, Modification, Biosorbent.**

## INTRODUCTION

Tannins are polyphenols materials or extracted compounds from plants [1]. The plant leaves, stems, bark, fruits, peels and seeds contained the tannin because the tannin are secondary metabolites of plants [2]. Tannins can be extracted from the persimmon peel [3-6], mangrove bark [7,8], guava leaves [9] and grape [10]. However, tannins derived from the skin of nephelium not studied in nephelium fruit peels contain compounds called polyphenols, such as tannins amounted to 23.25 % [11].

Tannin can be applied to various fields such as pharmaceutical compounds for the removal of antibiotic trimethoprim (TMP) [12], chemistry as a substitute for phenol in phenol-formaldehyde resins [7] and as adsorbent heavy metals such as cadmium in fish sauce [13] as well as inhibitors of metal corrosion rate [9].

Tannins are derived from nephelium peel extract is hydrolyzed tannins that will easily dissolve in polar compounds such as water [11]. The biosorbent for metal ions are expected to have a high stability in solution, so that the tannins extract from the nephelium peel necessary modifications to improve stability without decreasing performance. The one of modification through condensation polymerization reaction with formaldehyde compounds as cross-linker [7].

In this study, the tannins produced from the nephelium peel will be used as material biosorbent for the metal ions in solution. The synthesis process of biosorbent material is need for a study of the parameters that affect the synthesis and modification of the nephelium tannin based biosorbent (NTBB). The parameters examined in this study are the temperature of the tannin extraction from the nephelium peel toward the result of extract tannin polymerization with formaldehyde to form NTBB. The other parameters are stability determination of NTBB in acidity system to produce a material that is stable and optimum performance as biosorbent in solution.

## EXPERIMENTAL

The nephelium peel was obtained from Binjai, North Sumatra, Indonesia. NaOH, HCl, HCHO were purchased from Merck with pro analysis (p.a) quality and used without purification.

Extraction of tannin from the lappaceum peel was conducted by reacting 10 g of nephelium peel powder (240 mesh) with 200 mL of 0.2 M NaOH at temperature variations (room temperature, 50, 70, 90 °C) for 2 h. Solids and solutions were separated by filtration using Whatman filter paper No.42. Fraction solution is called filtrate and then dried at 65 °C to obtain crystalline solid. The weight of tannin extract solids after drying was measured.

Synthesis of NTBB was done by dissolving 3 g in 60 mL of NaOH 0.2 M and 40 mL of $H_2O$ at 80 °C until it becomes a homogenous mixture. The mixture was then added 11.44 mL of formaldehyde 35%. The mixture was kept under these conditions for 8 h until polymerization is formed. Gel that has formed is then dried at 65 °C to remove water and form a gel to be more solid. These results are called nephelium tannin based biosorbent (NTBB).

The stability study of NTBB was done by mixing 25 mg of NTBB in 20 mL $H_2O$. The solution was adjusted acidity using pH meter in the variation of pH 2, 3, 4, 5, 6, 7, 8 and 9. The mixture was stirred for 1 h and then filtered using Whatman filter paper No. 42.

**Detection method:** Characterization of all materials from NTBB used a Fourier transform infrared (FTIR) (Simadzu Prestige-21) to determine functional group and to obtain the stability of NTBB in acidic system by using UV-visible spectrophotometer.

## RESULTS AND DISCUSSION

Extraction of tannin from the nephelium peel powder was done by varying the extraction temperature. Temperatures were used ranging from room temperature, 50, 70 and 80 °C. The influence of temperature on the extraction process of tannin is shown in Fig. 1.

Fig. 1 shows that the extraction temperature affects the amount of tannin extract from the extraction process using an alkaline base (NaOH). The higher the temperature, the amount of tannin extraction generated also increases. The tannin extract polymerization was then performed using formaldehyde 35 % and then be characterized by FTIR spectrophotometer to determine the effect of temperature on the quality of tannin extraction based functional group. The influence of extraction temperature on the NTBB shown by FTIR spectra (Fig. 2).

Nephelium tannin based biosorbent polymerization result showed some characteristic absorption peak at wavenumber

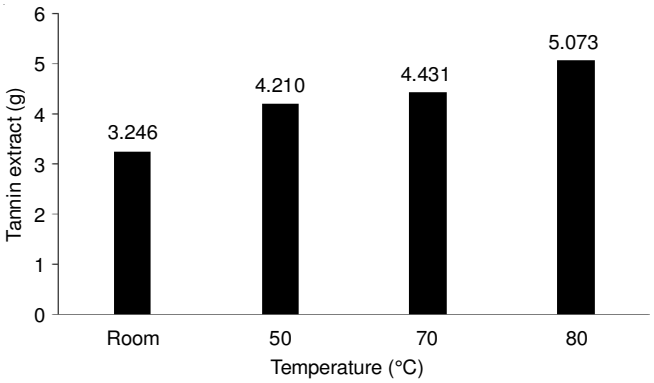


Fig. 1. Amount of tannins extract from 10 g of nephelium peel in 200 mL of 0.2 M NaOH by varying extraction temperature

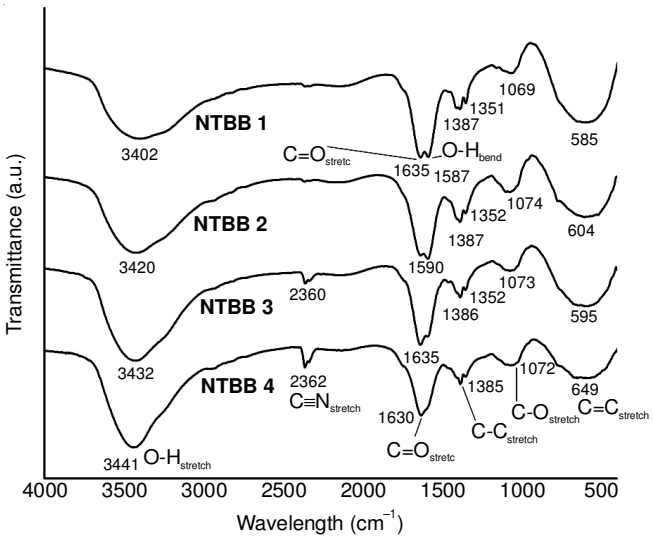


Fig. 2. FTIR spectra of NTBB from tannin extract by varying extraction temperature

600, 1000, 1350, 1600 and 3400 $cm^{-1}$. Fig. 2 shows that the extraction temperature affected the FTIR spectra of generated

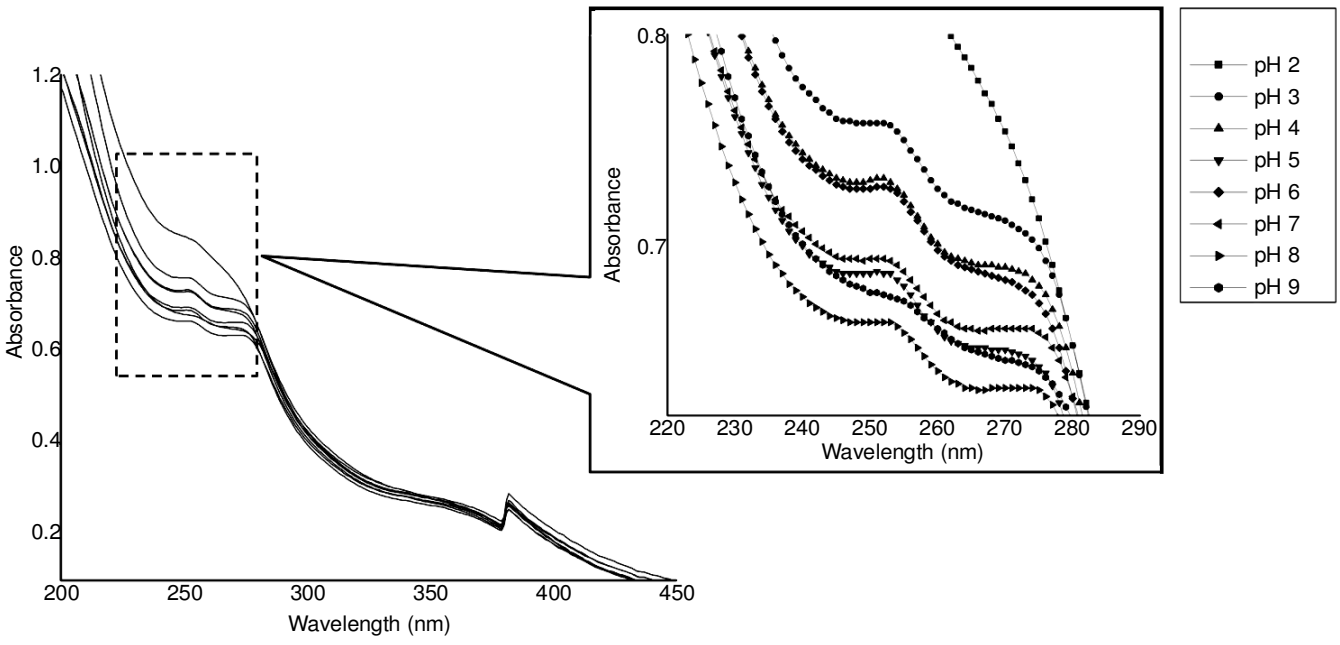


Fig. 3. Stability of NTBB in variation of system acidity

biosorbent. FTIR spectra were NTBB 1 (tannin extract from room temperature), NTBB 2 (tannin extract from 50 °C), NTBB 3 (tannin extract from 70 °C) and NTBB 4 (tannin extract from 80 °C). Polymerization process of extract tannin with aldehyde compound showed that the polymer compound of NTBB been formed as indicated by the appearance of absorption peaks at 1074-1069 $cm^{-1}$ and which is the vibration of C-O ether group as methylene ether bridge [12]. NTBB 3 and NTBB 4 have absorption peak at 2362-2360 $cm^{-1}$. The peak was due to the uptake of cyanide (-CN) due to high temperature extraction. This causes HCN loose and bounded to the polymer tannins (NTBB).

Fig. 3 showed that the stability of NTBB was affected by the acidity of the system. Acidity system at pH 8 gives the highest stability among the acidity of another system. The solubility of NTBB is greater in the acidic system. This was shown in Fig. 3 in which the more acidic system, the peak at a wavelength around 240-280 nm higher, it indicated that the greater the absorption of polyphenol groups from tannin dissolved in the solution [14].

## Conclusion

The temperature variation in the extraction process of tannins from the nephelium peel powder can affect the amount of tannin extract and the results of polymerization. The higher the extraction temperature, the amount of tannin extracts was also greater reach 5.073 g and the higher extraction temperature cause HCN will be released and attached on NTBB polymer that was detected on the 2360 $cm^{-1}$ as –CN vibration (cyanide group). The stability of NTBB in solution shows that NTBB will easily dissolve in the system high acidity so that it will form a high peak at a wavelength of 240-280 nm using a UV-visible spectrophotometer and NTBB have the optimum stability in solution occurs at pH 5.

## ACKNOWLEDGEMENTS

The author thank the Directorate of Research and Community Service Universitas Islam Indonesia or Direktorat Penelitian dan Pengabdian Masyarakat Universitas Islam Indonesia (DPPM UII) for giving grants to this research.

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