

## An assessment for alkaline treatment in ABA method to charcoal sample for $^{14}\text{C}$ dating (AMS)

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The Acid-Base-Acid (ABA) method is one of charcoal treatment methods for  $^{14}\text{C}$  dating. The evaluation of processing conditions of the ABA method based on any chemical indicator does not exist until today. An assessment against wood charcoal using Raman spectrometry has been tried, but the result only suggests that it is possible to detect the inclusion of humic acid in charcoal samples by Raman spectrometry but the relation between pretreatment efficiency and  $^{14}\text{C}$  dates has not been investigated. Therefore, this study aims to confirm the error in  $^{14}\text{C}$  dating generated by the alkaline pretreatment which is not clarified hitherto. The results show that medians of dates of samples treated with NaOH solution are scattered in the range of 57  $^{14}\text{Cyr}$  whereas medians of dates of samples untreated with NaOH solution are scattered in the range of 216  $^{14}\text{Cyr}$ . The results of chi-squared test show  $T=0.45$ ( $df=3$ ; 5% risk rate  $T > 12.59$ ) for the treated samples which means high convergent validity, while  $T=10.74$  ( $df=4$ ; 5% risk rate  $T > 9.49$ ) for the untreated samples which means large scattering and significant variation. In addition, dates of the untreated samples include younger (3589 plus-minus 41 BP) date and older (3805 plus-minus 40 BP) date in comparison to the average date of the treated samples (3701 plus-minus 43 BP), which suggests that  $^{14}\text{C}$  dates are made younger or older by the pollution or contamination of charcoal. Those results stated above partially attests the effectiveness of the ABA method.

Keywords: radiocarbon dating, charcoal, archaeological sample, ABA method