

APPLICATION OF ULTRASONIC-ASSISTED ENZYMATIC DIGESTION SYSTEM
FOR DIGESTION OF COCKLES

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Specially dedicated to my beloved family and friends

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ABSTRACT

Sample preparation is the most time consuming part of elemental analysis where homogeneous samples that are almost free from organic matter is necessary. Therefore, preliminary operations such as separation of interferences and preconcentration of the analytes are required prior to analysis. Ultrasonic digestion recently proposed as an efficient method for extraction of trace metals from solid samples. The ultrasonic digestion was optimized by using two parameters whilst another two other parameters were used in enzymatic digestion. Conventional one-variable-at-a-time (OVAT) optimization method was applied to both digestion techniques. Fe and Zn were extracted from the samples and were determined by using flame atomic absorption spectrometry (FAAS). The combination of ultrasonic and enzymatic digestion techniques is known as Ultrasonic-Assisted Enzymatic Digestion (USAED) method. The ultrasonication equipment used was ultrasonic bath. Four parameters studied for optimization were sample mass, sonication time, protease enzyme volume and incubation time. The optimum condition of parameters for sample mass was 0.2 g, sonication time of 30 min whilst for enzyme volume was 1000 μ L and for incubation time of 24 hours. For the kinetic study, these reactions had undergone zero order reaction. This USAED method was successfully applied for the digestion and kinetic study of the cockle samples.

ABSTRAK

Penyediaan sampel bagi analisis unsur memerlukan masa yang panjang bagi memastikan semua sampel adalah bebas daripada kebanyakan bahan organik. Oleh sebab itu, proses permulaan sebelum analisis seperti proses pemisahan gangguan dan kepekatan analit adalah sangat diperlukan. Kaedah penghadaman ultrasonik dalam masa sekarang dicadangkan sebagai cara paling berkesan bagi mengekstrak logam daripada sampel pepejal. Proses pengoptimuman turut dijalankan untuk mendapatkan hasil penghadaman yang terbaik. Dua parameter di kaji dengan menggunakan teknik penghadaman ultrasonik manakala dua parameter lagi digunakan bagi teknik penghadaman enzim. Kaedah biasa iaitu kaedah satu pemboleh ubah bagi satu masa diaplikasikan bagi kedua-dua teknik penghadaman. Logam Fe dan Zn diekstrak daripada sampel dan ditentukan dengan menggunakan spektroskopi serapan atom nyalaan (FAAS). Hasil gabungan teknik penghadaman ultrasonik dan penghadaman enzim dikenali sebagai kaedah penghadaman berbantuan ultrasonik dan enzim (USAED). Peralatan yang digunakan untuk ultrasonic ialah mandian ultrasonik. Empat parameter yang dikaji untuk pengoptimuman ialah berat sampel, masa sonikasi, isipadu enzim dan masa inkubasi. Keadaan optimum bagi parameter berat sampel ialah 0.2 g, masa sonikasi ialah 30 minit manakala bagi isipadu enzim ialah 1000 μ L dan masa inkubasi ialah 24 jam. Bagi kajian kinetik pula, tindak balas menepati tertib sifar. Kaedah USAED ini telah berjaya diaplikasikan untuk proses penghadaman dan kajian kinetik bagi sampel kerang.