

**KAJIAN PENGARUH WAKTU SONIKASI, JUMLAH PREKURSOR,  
DAN METODE PENGHILANGAN SURFAKTAN TERHADAP  
KRISTALINITAS PRODUK DALAM SINTESIS MCM-48 DARI SEKAM  
PADI**

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**INTISARI**

Kajian tentang pengaruh waktu sonikasi, jumlah prekursor, serta metode penghilangan surfaktan terhadap kristalinitas MCM-48 telah dilakukan. Tujuan penelitian ini untuk memperoleh material MCM-48 dengan bahan dasar silika dari sekam padi menggunakan metode sonokimia, mempelajari pengaruh waktu sonikasi dan jumlah prekursor terhadap kristalinitas MCM-48, serta melakukan studi komparasi dalam metode penghilangan surfaktan. Ekstraksi silika dari sekam padi dilakukan pada suhu 60 °C selama 3 jam dengan pelarut HCl. Sintesis MCM-48 dilakukan dengan menggunakan surfaktan *cetyltrimethylammonium bromide* (CTMABr) dan dilakukan variasi waktu sonikasi selama 90, 120, 150, dan 180 menit, serta dengan jumlah prekursor sebanyak 1 resep (0,067 mol SiO<sub>2</sub>, 0,031 mol NaOH, 0,014 mol CTMABr, dan 5 mol H<sub>2</sub>O), 3/4 resep (0,05 mol SiO<sub>2</sub>, 0,016 mol NaOH, 0,01 mol CTMABr, dan 3,75 mol H<sub>2</sub>O), dan 1/2 resep (0,033 mol SiO<sub>2</sub>, 0,016 mol NaOH, 0,0069 mol CTMABr, dan 2,5 mol H<sub>2</sub>O). Penghilangan surfaktan dari MCM-48 hasil sintesis dilakukan dengan metode sonokimia dalam larutan etanol 70%, kalsinasi pada suhu 500 °C selama 4 jam, pencucian dengan 1:10 amonium karbonat-etanol, dan pencucian dengan 0,1 M HCl-etanol. Material MCM-48 yang dihasilkan dikarakterisasi dengan metode XRD (XRD), Spektroskopi *Fourier Transform Infra Red* (FTIR), *Scanning Electron Microscope* (SEM) dan adsorpsi-desorpsi gas N<sub>2</sub>. Hasil penelitian menunjukkan bahwa MCM-48 berhasil terbentuk pada waktu sonikasi selama 120 menit dan jumlah prekursor sebanyak 1 resep. Penghilangan surfaktan dengan HCl-etanol merupakan metode penghilangan surfaktan CTMABr yang paling baik dalam penelitian ini. Hasil karakterisasi dengan SEM menunjukkan aglomerasi partikel, sedangkan karakterisasi dengan adsorpsi-desorpsi gas nitrogen menunjukkan MCM-48 memiliki luas permukaan spesifik 25,85 m<sup>2</sup> g<sup>-1</sup>, volume pori spesifik 0,083 cc g<sup>-1</sup>, dan rata-rata diameter pori 12,97 nm.

Kata kunci: MCM-48, sekam padi, sonikasi, jumlah prekursor.

## **STUDY OF THE SONICATION TIME, PRECURSOR AMOUNT, AND SURFACTANT REMOVAL METHODS TOWARDS THE CRYSTALLINITY OF SYNTHESIZED MCM-48 FROM RICE HUSK**

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### **ABSTRACT**

Study of the influence of sonication time, the amount of precursor, and surfactant removal methods towards the crystallinity of MCM-48 has been carried. The purposes of this research were to synthesis MCM-48 materials from rice husk using sonochemistry method, determine the effect of sonication time and the amount of precursor towards the MCM-48 crystallinity, and comparatively study of surfactant removal methods. Extraction of silica from rice husk was carried out at 60 °C for 3 hours using HCl as a solvent. MCM-48 was synthesized using cetyltrimethylammonium bromide (CTMABr) as surfactant and were performed under a variation of sonication time of 90, 120, 150, and 180 minutes and under the amount variation of precursor as much as 1 recipe (i.e. 0,067 mol SiO<sub>2</sub>, 0,031 mol NaOH, 0,014 mol CTMABr, and 5 mol H<sub>2</sub>O), 3/4 recipe (i.e. 0,05 mol SiO<sub>2</sub>, 0,016 mol NaOH, 0,01 mol CTMABr, and 3,75 mol H<sub>2</sub>O), and 1/2 recipe (i.e. 0,033 mol SiO<sub>2</sub>, 0,016 mol NaOH, 0,0069 mol CTMABr, and 2,5 mol H<sub>2</sub>O). Surfactant removal of MCM-48 were carried out by sonication using ethanol 70% as a solvent, calcinations at 500 °C for 4 hours, washing with 1:10 ammonium carbonate-ethanol, and washing with 0,1 M HCl-ethanol. MCM-48 were characterized by X-Ray Diffraction (XRD), Fourier Transform Infra Red (FTIR) Spectroscopy, Scanning Electron Microscope (SEM) and adsorption-desorption of N<sub>2</sub> methods. The result showed that MCM-48 can be formed at the time of sonication for 120 minutes and the amount of precursor of 1 recipe. Surfactant removal using HCl-ethanol is the best method in this study for removing CTMABr from MCM-48. The result of characterization using SEM showed particle agglomeration, while the characterization using adsorption-desorption of nitrogen gas showed that the specific surface area of MCM-48 was 25.85 m<sup>2</sup> g<sup>-1</sup>, the specific pore volume was 0.083 cc g<sup>-1</sup>, and the average pore diameter up to 12.97 nm.

Keywords: MCM-48, rice husk , sonication, the amount of precursor