

**NOVEL POLYBENZOXAZINE-BASED CARBON AEROGEL ELECTRODE
FOR SUPERCAPACITORS**



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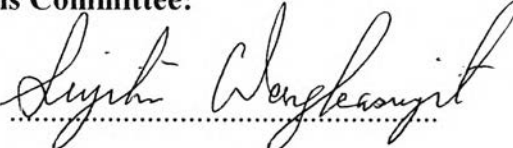
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ABSTRACT

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In this study, polybenzoxazine, a new high performance thermosetting resin, was used to prepare carbon aerogels used as an electrode for supercapacitors. Two types of polybenzoxazines, derived from two different amines, aniline and triethylenetetramine, and denoted as BA-a and BA-teta, respectively, were chosen as the reactants for the organic precursor preparation. The surface areas of carbon aerogels from both BA-a and BA-teta were 391 and 368 m²/g, respectively. The pore size of each carbon aerogel was in the range of 2 to 5 nm which is a suitable pore size for being used as electrodes in electrochemical application. The electrochemical properties of the obtained carbon aerogels showed good performance for supercapacitor applications with specific capacitance of 55.78 and 20.53 F/g for BA-teta and BA-a, respectively. At low voltage scanning, 1 and 5 mV/s, the cyclic voltammogram of the carbon aerogel derived from BA-teta gave better rectangular shape than that of the other carbon aerogel. Impedance spectra of both carbon aerogels confirm the results of the specific capacitance and the cyclic voltammogram analyses.

บทคัดย่อ

ประวัติวิทยุ : การพัฒนาคาร์บอนแอโรเจลที่ใช้เป็นขั้วเก็บประจุไฟฟ้าที่มีประสิทธิภาพสูงซึ่งผลิตมาจากพอลิเบนซอกซาซีน (Novel Polybenzoxazine-Based Carbon Aerogel Electrode for Supercapacitors) อ.ที่ปรึกษา : รองศาสตราจารย์ ดร.สุจิตรา วงศ์เกษมจิตต์ และ ดร.ธัญญลักษณ์ ฉายสุวรรณ 51 หน้า

ในการศึกษาครั้งนี้ พอลิเบนซอกซาซีนซึ่งเป็นเรซินที่มีประสิทธิภาพแบบใหม่ถูกนำมาใช้เตรียมคาร์บอนแอโรเจลสำหรับขั้วไฟฟ้าของขั้วเก็บประจุไฟฟ้าที่มีประสิทธิภาพสูง พอลิเบนซอกซาซีนซึ่งทำมาจากเอมีน 2 ชนิด ที่ต่างกันคือ อะนิลีน และ ไตรเอทิลอซิโตนเตตระมีน หมายถึง BA-a และ BA-teta ตามลำดับ ถูกเลือกให้เป็นสารตั้งต้นสำหรับการเตรียมสารประกอบอินทรีย์ โดยคาร์บอนแอโรเจลที่ได้จาก BA-a และ BA-teta มีค่าพื้นที่ผิว 391 ถึง 368 ตารางเมตรต่อกรัม ตามลำดับ ส่วนขนาดของรูพรุนอยู่ในช่วง 2 ถึง 5 นาโนเมตร ซึ่งเป็นขนาดรูพรุนที่เหมาะสมสำหรับขั้วไฟฟ้าในด้านเคมีไฟฟ้า คุณสมบัติทางเคมีไฟฟ้าของคาร์บอนแอโรเจลแสดงประสิทธิภาพที่ดีในการนำมาใช้เป็นขั้วเก็บประจุไฟฟ้าที่มีประสิทธิภาพสูงด้วยค่าความจุไฟฟ้าจำเพาะ 55.78 และ 20.53 ฟารัดต่อกรัมของ BA-teta และ BA-a ตามลำดับ ที่อัตราความต่างศักย์ต่ำคือ 1 และ 5 มิลลิโวลต์ต่อวินาที ไซคลิกโวลแทมโมแกรมของคาร์บอนแอโรเจลที่ได้จาก BA-teta มีลักษณะเป็นรูปสี่เหลี่ยมมุมฉากที่ดีกว่าคาร์บอนแอโรเจลอีกตัว อิมพีแดนซ์ สเปกตรัมของคาร์บอนแอโรเจลทั้งสองซึ่งยืนยันผลของค่าความจุไฟฟ้าจำเพาะและผลวิเคราะห์ของไซคลิกโวลแทมโมแกรม

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ABBREVIATION

BA-teta	Benzoxazine is based on bisphenol-A and triethylenetetramine
BA-a	Benzoxazine is based on bisphenol-A and aniline
CA(BA-teta)	Carbon Aerogel derived from BA-teta
CA(BA-a)	Carbon Aerogel derived from BA-a