

**PREPARATION AND CHARACTERIZATION OF JUTE- AND FLAX-
REINFORCED STARCH-BASED COMPOSITE FOAMS**



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ABSTRACT

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Keywords : Starch-based composite foam/ Fiber reinforcement/ Baking process/ Mechanical property

Starch-based composite foams (SCFs) were successfully prepared by baking starch-based batters incorporating either jute or flax fibers inside a hot mold. The effect of moisture content on the mechanical properties of SCFs was investigated. Both the flexural strength and the flexural modulus of elasticity appeared to be markedly improved with addition of 5 to 10% by weight of the fibers. At a fixed fiber content of 10% by weight, both the flexural strength and the flexural modulus of elasticity were found to increase with increasing aspect ratio of the fibers. The improvement in the mechanical properties of SCFs was attributed to the strong interaction between fibers and the starch matrix, as evidenced by a series of scanning electron micrographs being taken on SCF fracture surface. Between jute- and flax-reinforced SCFs, jute fibers had a greater reinforcing effect than flax fibers did. Orientation of fibers was shown to have a strong effect on both the flexural strength and the flexural modulus of elasticity of SCFs, with the highest values being observed on specimens having fibers oriented in the longitudinal direction (fibers oriented perpendicularly to the crack propagation direction).

บทคัดย่อ

ณัฐกานต์ สร้อยกาบแก้ว: การเตรียมและการศึกษาคุณลักษณะของโฟมเชิงประกอบจากแป้งมันสำปะหลัง โดยใช้เส้นใยปอและป่านเป็นวัสดุเสริมแรง (Preparation and Characterization of Jute- and Flax-Reinforced Starch-Based Composite Foams) อ. ที่ปรึกษา: ผศ. ดร. รัตนา รุจิรวนิช ผศ. ดร. พิชญ์ สุภผล และ รศ. ดร. เดวิด ซี มาร์ติน 75 หน้า ISBN 974-17-2332-6

โฟมเชิงประกอบซึ่งเตรียมโดยใช้แป้งมันสำปะหลังเป็นส่วนประกอบหลักและใช้เส้นใยปอและป่านเป็นวัสดุเสริมแรงถูกขึ้นรูปเป็นโฟมโดยวิธีการอบ ในงานวิจัยนี้ได้ทำการศึกษาผลกระทบของปริมาณความชื้นในโฟมเชิงประกอบที่มีต่อคุณสมบัติเชิงกล จากการศึกษาพบว่าค่าความแข็งแรงและค่าโมดูลัสของความยืดหยุ่นของโฟมเชิงประกอบนี้ ได้รับการปรับปรุงขึ้นเป็นอย่างมากจากการใช้ปอและป่านเป็นวัสดุเสริมแรงในปริมาณร้อยละ 5-10 โดยน้ำหนัก จากนั้นเมื่อกำหนดปริมาณของเส้นใยที่ใช้ให้คงที่ที่ร้อยละ 10 โดยน้ำหนัก พบว่าค่าความแข็งแรงและค่าโมดูลัสของความยืดหยุ่นของโฟมเชิงประกอบนี้มีค่าสูงขึ้นอย่างเห็นได้ชัด เมื่อค่าอัตราส่วนระหว่างความยาวต่อเส้นผ่าศูนย์กลางของเส้นใยเพิ่มขึ้น การปรับปรุงคุณสมบัติเชิงกลนี้เป็นผลเนื่องมาจากการยึดเกาะที่แข็งแรงระหว่างเส้นใยและเนื้อแป้ง โดยยืนยันได้จากชุดภาพถ่ายแบบอิเล็กตรอนส่องกราดบนผิวหน้าตัดที่หักของโฟมเชิงประกอบ จากการศึกษาเปรียบเทียบระหว่างโฟมเชิงประกอบที่ถูกเสริมแรงโดยใช้เส้นใยปอและป่าน พบว่าเส้นใยปอให้ผลของการเสริมแรงดีกว่าเส้นใยป่าน และจากการศึกษาผลของทิศทางการจัดเรียงตัวของเส้นใยในโฟมเชิงประกอบพบว่าทิศทางการจัดเรียงตัวของเส้นใยมีผลกระทบอย่างมากต่อค่าความแข็งแรงและค่าโมดูลัสของความยืดหยุ่น โดยโฟมเชิงประกอบซึ่งมีเส้นใยจัดเรียงตัวในทิศทางตามยาวของโฟมให้ค่าคุณสมบัติเชิงกลที่ดีที่สุด เนื่องจากทิศทางการจัดเรียงตัวนี้เส้นใยจะจัดเรียงตัวในแนวตั้งฉากกับแนวการหักของโฟมเชิงประกอบ

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