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MODIFICATION OF MECHANICAL PROPERTIES OF POLY(METHYL METHACRYLATE)
USED FOR DENTURE BASE MATERIAL BY USING BAMBOO FIBER

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งานวิจัยนี้มุ่งเน้นที่จะศึกษาถึงผลทางสมบัติเชิงกลของการนำเส้นใยไผ่เป็นวัสดุเสริมแรงในพอลิเมทิลเมทาคริเลต (PMMA) ซึ่งเป็นวัสดุหลักเพื่อใช้ทำฐานฟันปลอม โดยปริมาณของเส้นใยที่ใช้คือ 0, 5, 10 และ 20 % โดยน้ำหนัก ซึ่งจะศึกษาถึงแนวโน้มทางสมบัติเชิงกล คือ ค่าการทนต่อแรงดัดโค้ง (Flexural Strength) โมดูลัสของการโค้งงอ (Flexural Modulus) ค่าการทนต่อแรงกระแทก (Impact Strength) และค่าการทนต่อแรงกด (Compressive Strength) โดยในงานวิจัยนี้ได้มีการใช้แกมมา-เมทาคริลอวกซีไพโรฟิวไตรเมธอกซีไซเลน (γ -MPS) เป็นสารประสานคู่ควบ (Coupling Agent) เพื่อเพิ่มการเกาะยึดระหว่างผิวสัมผัสของเส้นใยไผ่กับ PMMA ได้มีการศึกษาเปรียบเทียบผลของการใช้สารประสานคู่ควบดังกล่าว นอกจากนี้ยังมีการศึกษาผลของความยาวต่อเส้นผ่านศูนย์กลางของเส้นใย (Aspect Ratio) ต่อสมบัติเชิงกล จากการศึกษาเปรียบเทียบ PMMA ที่ไม่มีการเสริมแรงกับที่มีการเสริมแรงพบว่าเมื่อใส่เส้นใยตั้งแต่ 5% โดยน้ำหนัก จะทำให้โมดูลัสของการโค้งงอมีค่าเพิ่มขึ้นมากกว่า 20 % และช่วยเพิ่มค่าการทนต่อแรงกดมากกว่า 10 % ขณะที่ค่าการทนต่อแรงดัดโค้งลดลงอย่างน้อย 10 % ขึ้นไป เมื่อมีการใช้ γ -MPS ที่ปริมาณเส้นใย 5 % โดยน้ำหนักพบว่าสมบัติค่าการทนต่อแรงกดมีค่าเพิ่มขึ้น 10 % เมื่อเทียบกับการไม่ใช้สารประสานคู่ควบ และค่าการทนต่อแรงกระแทกมีค่ามากกว่า PMMA ที่ไม่มีการเสริมแรง 220 % ในขณะที่ค่าการทนต่อแรงดัดโค้งมีค่าลดลงมากกว่าผลิตภัณฑ์ประกอบแต่งที่ไม่ใช้สารประสานคู่ควบเท่ากับ 10 % เมื่อมีการเปรียบเทียบ PMMA ที่มีการเสริมแรงด้วยเส้นใยที่มี Aspect Ratio ต่างกัน พบว่าเมื่อ PMMA ที่มีการเสริมแรงด้วยเส้นใยที่มี Aspect Ratio เท่ากับ 126.5 จะมีค่าการทนต่อแรงดัดโค้งที่สูงเพิ่มขึ้น 15 % เมื่อเทียบกับผลิตภัณฑ์ประกอบแต่งที่เส้นใยมี Aspect Ratio เท่ากับ 79.7 และจากภาพถ่ายของกล้องจุลทรรศน์อิเล็กตรอนชนิดส่องกราด (Scanning Electron Microscope, SEM) พบว่าการใช้ γ -MPS จะทำให้เกิดการเกาะยึดระหว่างผิวสัมผัสของเส้นใยกับ PMMA ดีขึ้น

ภาควิชา วิศวกรรมเคมี
สาขาวิชา วิศวกรรมเคมี
ปีการศึกษา 2544

ลายมือชื่อนิสิต.....สุนันท์ ทิพย์ทิพากร.....
ลายมือชื่ออาจารย์ที่ปรึกษา.....ณัฐพร โทณานนท์.....

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KEY WORD: DENTURE BASE / PMMA / BAMBOO FIBER / COMPOSITE / FIBER CONTENT / ASPECT RATIO / γ -MPS / COUPLING AGENT / INTERFACIAL ADHESION.

SUNAN TIPTIPAKORN: MODIFICATION OF MECHANICAL PROPERTIES OF POLY(METHYL METHACRYLATE) USED FOR DENTURE BASE MATERIAL BY USING BAMBOO FIBER. THESIS ADVISOR: NATTAPORN TONANON, 145 pp.

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The aim of this research is to study the mechanical effect of bamboo fiber as reinforcing material in poly(methyl methacrylate) (PMMA) used as denture base material. The composites with various fiber contents (0 to 20-wt %) were studied to find the trend of mechanical-property change, such as, flexural strength at break, flexural modulus, impact strength and compressive strength. In order to improve the interfacial adhesion between fiber and matrix, Gamma-methacryloxypropyltrimethoxysilane coupling agent (γ -MPS) was used. Comparative study of the bamboo fiber / PMMA composites with and without the coupling agent were carried out. Furthermore, the effect of aspect ratio of the bamboo fiber was also studied. It was found that the addition of more than 5-wt % of fiber tended to increase the flexural modulus at break at least 20 %, and compressive strength over 10%, but decrease the flexural strength at least 10 %. At 5-wt % loading, the bamboo fiber / PMMA composites with γ -MPS provided 10 % increase of compressive strength compared with the composite without coupling agent, 220 % increase of impact strength compared with PMMA without reinforcement, and 10 % decrease of the flexural strength compared with the composite without coupling agent. The composites with 126.5 aspect-ratio fiber had 15 % higher flexural strength than the ones with 79.7 aspect-ratio fiber. Morphology of the composites was observed by Scanning Electron Microscope (SEM). It was revealed that the composites with coupling agent had better adhesion between the interfacial surface than those without coupling agent had.

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