

# Tensile Strength Between Nanosisal Composite with Nanofiller Composite Dental Restorative Material

Dwi Aji Nugroho<sup>1,2</sup>, Widjijono<sup>3</sup>, Nuryono<sup>4</sup>, Widya Asmara<sup>5</sup>, Ensa Dyota Wibuthi<sup>2</sup>

<sup>1</sup>Doctoral Programme, Faculty of Dentistry, Universitas Gadjah Mada, Jl. Denta Sekip Utara, Bulaksumur, Yogyakarta, Indonesia, email: [dwiainugrohodrg@gmail.com](mailto:dwiainugrohodrg@gmail.com)

<sup>2</sup>Dental School, Faculty of Medical and Health Science, Universitas Muhammadiyah Yogyakarta Jl. Brawijaya, Tamantirto, Kasihan Bantul, Yogyakarta 55183, Indonesia, email: [dwiajidrg@umy.ac.id](mailto:dwiajidrg@umy.ac.id)

<sup>3</sup>Department of Biomaterial, Faculty of Dentistry, Universitas Gadjah Mada, Jl. Denta Sekip Utara, Bulaksumur, Yogyakarta, Indonesia

<sup>4</sup>Department of Chemistry, Faculty of Mathematics and Natural Science, Universitas Gadjah Mada Sekip Utara PO BOX Bulaksumur 21 Yogyakarta 55281, Indonesia

<sup>5</sup>Department of Microbiology, Faculty of Veterinary, Universitas Gadjah Mada, Jl. Fauna No.2 Caturtunggal, Depok, Sleman, Yogyakarta, Indonesia

---

**Introduction.** Dental Composite consists of matrix resin, coupling agents, filler, and other supportive materials, its filler is inorganic materials [1]. Their characteristics are non-biodegradable, non-renewable, non-recyclable that contained in composite resin [2]. Natural fiber can be used as substitute for inorganic filler. The most potential natural fiber such as sisal fiber (*Agave sisalana*) [3]. Sisal fibers are hard and strong fibers derived from sisal plants and can be used as mechanical amplifiers to the matrix resin [3]. This study has manufactured composite resins with sisal that sized nano as their filler and we called nanosisal dental composite. Nanosisal filler volume was recommended at 60% [4]. Tensile strength can predict bond strength reliably for material endurance clinically [5]. This study aimed to determine the difference of tensile strength between nanosisal composite 60% filler with nanofiller dental restorative composite.

**Experimental.** Sisal fiber converted into nano-sized sisal, labeled as nanosisal. Nanosisal mixed with Bisphenol A glycerolate dimethacrylate (Bis-GMA, Sigma Aldrich), Diurethane dimethacrylate (UDMA, Sigma Aldrich), Triethylene glycol Dimethacrylate (TEGDMA, Sigma Aldrich), Champhorquinone (Sigma Aldrich). Nanofiller composite (Z350 XT 3M ESPE) was utilized as control. We used 10 cone-sized sample (4 x 4 x 2 mm). They divided into 2 groups. Nanosisal composite 60% labeled as group A, nanofiller composite labeled as group B. Extracted premolar teeth were prepared to class V (G. V. Black classifications), then they were filled using samples with total etch adhesive system (3M ESPE). Samples were tested for tensile strength using a Universal Testing Machine. Data was analyzed by Independent Sample T-Test.

**Results and Discussion.** The mean of tensile strength of nanosisal 60% filler composite resin was 4.39 MPa, and nanofiller composite resin was 1.23 MPa. There was a significant difference in data analysis ( $p = 0.004$ ;  $p < 0.05$ ). It was caused by nanosisal composite has stronger bond formed between nanosisal fiber, matrix resin and adhesive due to chemical bond of OH groups [3].

**Conclusions.** The result showed that nanosisal 60% filler composite resin has higher tensile strength rather than nanofiller composite resin.

## References.

- [1] Anusavice KJ, Shen C, Rawls HR. Phillips' science of dental materials. 12<sup>th</sup> ed. 2012, St. Louis: Elsevier Saunders. p. 275-6.
- [2] Wambua P, Ivens J, Verpoest I. 2003, Natural fibres: can they replace glass in fibre reinforced plastics?. *Compos Sci Technol*; vol 63, p.1259-64.
- [3] Ahmad EEM. 2011, The influence of micro- and nano-sisal fibers on the morphology and properties of different polymers. Thesis. Phuthaditjhaba: University of The Free State. p.3-60.
- [4] Nugroho, D. A., Widjijono, W., Nuryono, N., Asmara, W., Astuti, W. D., & Ardianata, D, 2017, Effects of Filler Volume of Nanosisal in Compressive Strength of Composite Resin, *Dental Journal (Majalah Kedokteran Gigi)*; vol 183(32), p.183-187.
- [5] Kramer, M.R., Edelhoff, D., Stawarczyk, B., 2016, Flexural Strength of Preheated Resin Composites and Bonding Properties to Glass-Ceramic and Dentin, *Materials*, vol 9(83), p.1-14.