



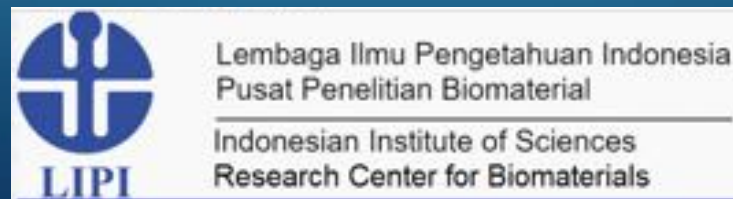
**farmalkes**



# WATER HYACINTH (EC.GONDOK) AS FIBER REINFORCEMENT COMPOSITE FOR PROSTHETICS SOCKET

POLITEKNIK KESEHATAN KEMENTERIAN KESEHATAN JAKARTA I

DHANNY WIDHATA MAHARDHIKA, B.SC.PO



# BACKGROUND

- People with disabilities in Indonesia by WHO 2011; 15%
- SUSENAS 2009, 33.75% overall disabilities
- RISKESDAS 2018, 11 % extremity disability



- Needs for the assisted device



## Indonesia Masih Bergantung pada Alat Kesehatan Impor

08:00 WIB 10/10/2018

By: [Korosi](#)



REPUBLIKA.CO.ID, JAKARTA — Di Kementerian Kesehatan (Kemkes) sekitar 92 persen atau 10.000 jenis kesehatan (jasa). Sementara itu, sekitar 80 persen alat kesehatan.

JAKARTA, KOMPAS.com — Perkumpulan Organisasi Perusahaan & Kemitraan dari Laboratorium atau Galeri di Indonesia mencatat, yang dipakai oleh rumah sakit di Indonesia sebagian besar impor.

Impor dilakukan karena keterbatasan bahan baku dari dalam negeri belum memenuhi standar mutu untuk keperluan medis.

"Alat kesehatan ini 92 persen masih impor, sehingga dengan ini untuk percepatan industri alat-alat kesehatan, kami juga menggeni untuk meningkatkan produk dari alat kesehatan dalam negeri," kata Umum Galeri Indonesia Teguh melalui konferensi pers pada (16/10/2018).

Teguh menjelaskan, Instruksi Presiden Nomor 6 Tahun 2016 to Percepatan Pengembangan Industri Farmasi dan Alat Kesehatan, mendorong anggota Galeri, dengan mulai mempromosikan industri baru berbasis di dalam negeri.

Dari 411 anggota Galeri, secara ada 10 anggota yang sudah memproduksi alat-alat kesehatan di dalam negeri.

Selama ini, alat-alat kesehatan yang diimpor cukup beragam, mulai harga menengah mahal dan berukuran besar sampai komponen & layanan kesehatan yang sederhana. Namun dari sekian banyak alat kesehatan, beberapa telah diproduksi di Indonesia, seperti alat portable, disposable gown, mesin anestesi, hingga jarum dan ben.

"Industri alat kesehatan ini memang spesifik, tidak seperti barang-barang lain, harus memenuhi standar mutu kualitas dan keamanan. Untuk industri dalam negeri, yang diproduksi adalah yang sangat-sangat sederhana," kata Teguh.

## 92 Persen Kebutuhan Alat Kesehatan Masih Impor

08:00 WIB

10/10/2018 08:00 WIB



Kualitas alat kesehatan dalam negeri masih belum memenuhi standar internasional, kata ...



Buana.com - Masih banyak berbagai fasilitas di rumah sakit ini ketergantungan Indonesia pada alat kesehatan (jasa) impor masih masih tinggi.

Berdasarkan data yang dirilis oleh Kementerian Kesehatan (Kemkes), hingga Oktober 2017, baru 11.000 atau 999 jenis alat yang diproduksi Kemkes alat-alat kesehatan (jasa) dalam negeri. Sedangkan 92 persen atau 10.000 jenis merupakan alat kesehatan impor.

# Teror Eceng Gondok di Danau Limboto



Arfandi Saphin  
18 Mei 2020, 10:00 WIB



kompasiana

## Eceng Gondok di Rawa Pening



Foto eceng gondok di Danau Limboto

Egpetank.com, Garut: 1

tuntas. Eceng gondok terus

Pemalen Egpetank.com dua

gondok. Tanaman yang sulit

# Wow, Butuh 13 Tahun Bersihkan Eceng Gondok di Danau Tondano, Jika Hanya Satu Alat

News, 21 Agustus 2017 11:02



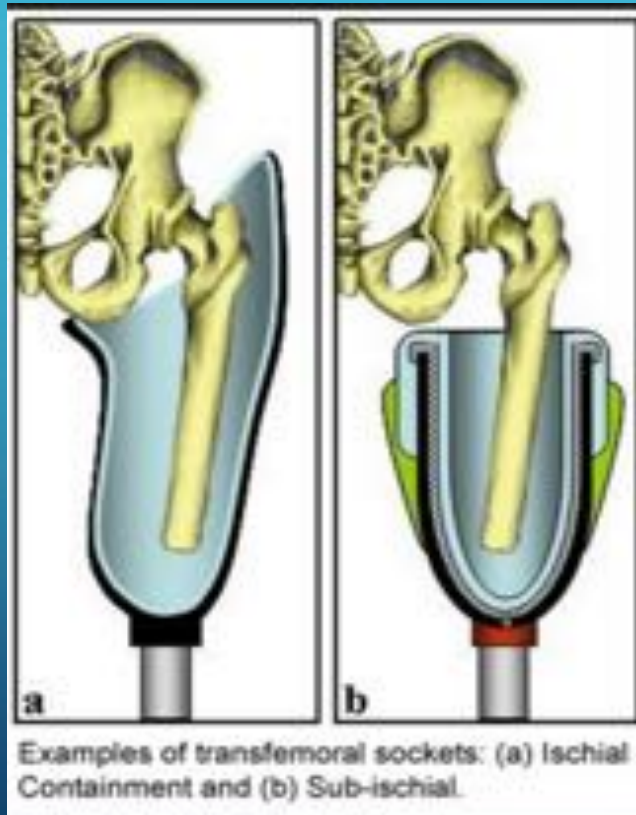
Foto: pondok wisata di tepi lapangan proyek Dam Tondano di kawasan wisata, atau Muksan, kawasan di sekitar Danau Tondano di Sulawesi



Laporan Wartawan Tribun Manado Ryo Nur

TRIBUNMANADO.CO.ID, TOMOHON - Permasalahannya membutuhkan waktu 13 tahun untuk membereskan masalah eceng gondok jika menggunakan satu unit mesin pembasmi eceng gondok. Aquatic Weed Hunter (AWH) di Danau Tondano

# COMMON PROSTHETICS SOCKET MADE OUT OF PLASTIC





**Environmental Problem**

# SOLUTION : WATER HYACINT AS REINFORCEMENT COMPOSITE MATERIALS

Fresh Plant



Dried Process



Weaving



laminated



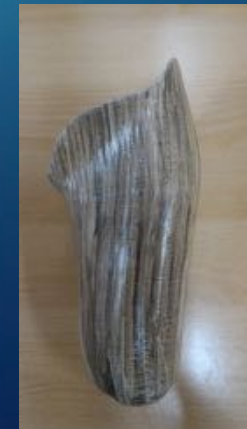
users



assembly



socket

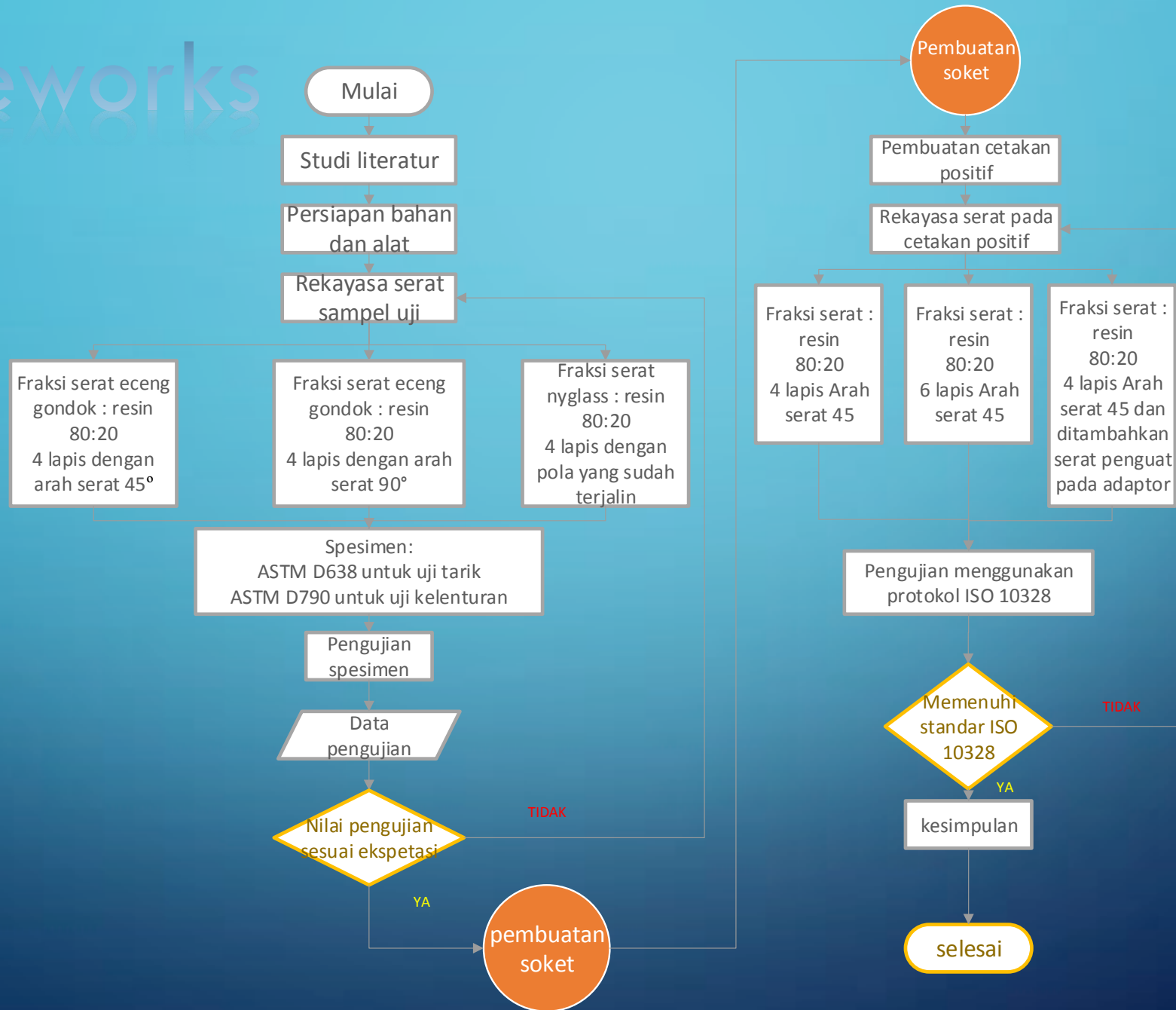


# WHY MUST BE WATER HYACINTH

- Is a natural fiber
- **Go Green**, this fiber can be composed by nature
- The production process is easy to apply and has economic value
- Empowering the community
- Not as rubbish but as a solution
- Used as other things in the form of household industries and handicrafts: bags, sandals, mats, etc.



# Frameworks



# FAILURE ANALYSIS

- Maximum stress theory
- Maximum strain theory
- Possibility modes of failure:
  - First – Ply Failure
  - Ultimate Laminate Failure (ULF)
  - Inter – laminar failure

# LITERATURE REVIEW

## Prosthetic limb sockets plant-based composite

Andrew I  
Harry KI

**Abstract**  
Background  
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Objectives: T  
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manufacture  
Study Design  
Methods: Te  
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and tested a  
Results: Com  
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Conclusions: I  
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**Keywords**  
Acrylic, com



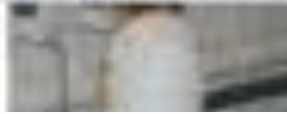
Figure 1. (a) Dimensions of the socket. (b) Tensile strength results graph showing Load (N) vs Displacement (mm). The graph compares three materials: (---) plant-based resin, (---) acrylic resin, and (---) for comparison the socket using BCC acrylic resin.



(a) Double layer of composite resin and plaster mould.



(b) A double layer of composite resin.



(a)



(b)

Figure 5. The standard leg socket mounted on the force loading machine (a) before and (b) after loading to destruction. Failure of the socket occurs at the distal end where the pyramid connector is attached to the socket.

**Table 1.** The fibre and resin combinations used for the four test sockets and their loadings at failure. The plant oil resin and ramie fibres socket fails at a higher loading than the standard layup. All sockets were manufactured with a final layer of Perlon stockinette. The plant oil resin and Nyglass socket (4a) test was repeated (4b) due to foaming of the resin (see text for explanation).

| Socket | Fibres              | Resin               | Wall thickness at distal end (mm) | Loading at failure (N) |
|--------|---------------------|---------------------|-----------------------------------|------------------------|
| 1      | Ramie stockinette   | Plant oil resin     | 9.5 ± 0.7                         | 6180                   |
| 2      | Nyglass stockinette | 80:20 Acrylic resin | 4.5 ± 0.6                         | 5808                   |
| 3      | Ramie stockinette   | 80:20 Acrylic resin | 6.0 ± 0.3                         | 4657                   |
| 4a     | Nyglass stockinette | Plant oil resin     | —                                 | 2223                   |
| 4b     | Nyglass stockinette | Plant oil resin     | 6.5 ± 0.6                         | 4255                   |

**Table 2.** Average (of five) ultimate tensile strength test results of the plant oil resin and natural fibre composite test pieces. For comparison, the data for test pieces made with the mineral fibres glass and carbon are included. Our results show that the combination of the plant oil resin with banana or ramie fibres gives the highest ultimate strength.

| Fibre             | Tensile strength (MPa) | Strain (%)  | Young's modulus (GPa) |
|-------------------|------------------------|-------------|-----------------------|
| Banana            | 82.7 ± 5.0             | 3.1 ± 0.4   | 2.4 ± 0.0005          |
| Ramie             | 80.8 ± 8.2             | 3.1 ± 0.7   | 4.0 ± 0.0007          |
| Seacell           | 66.1 ± 2.8             | 7.3 ± 0.6   | 2.5 ± 0.0009          |
| Flax              | 59.5 ± 5.0             | 2.7 ± 0.3   | 2.8 ± 0.0007          |
| Soya              | 55.8 ± 2.7             | 14.8 ± 1.2  | 1.7 ± 0.0007          |
| Corn              | 38.9 ± 0.8             | 36.5 ± 5.0  | 1.5 ± 0.0011          |
| Cotton            | 36.0 ± 4.1             | 3.8 ± 0.2   | 1.6 ± 0.0002          |
| Bamboo            | 29.9 ± 3.6             | 10.9 ± 2.9  | 1.1 ± 0.0002          |
| Carbon            | 1207.5 ± 201.0         | 2.0 ± 0.2   | 81.6 ± 0.0016         |
| Glass             | 56.8 ± 5.0             | 3.1 ± 0.1   | 2.6 ± 0.0001          |
| Phosor            | 281.6 ± 7.3            | 1.95 ± 0.02 | 1.0 ± 0.0001          |
| [plant oil resin] |                        |             |                       |

# RESULT OF TENSILE TEST

- composition water hyacinth : matrix = 80 : 20
- 4 layer

| Arah serat     | Nomor Speciment | Tensile strength ( $\sigma$ ) Mpa | Rerata tensile strength ( $\sigma$ ) Mpa | Maximum Load (Kg)/ mm <sup>2</sup> | Rerata maximum Load (Kg)/ mm <sup>2</sup> |
|----------------|-----------------|-----------------------------------|--|------------------------------------|---|
| Arah serat 0°  | 1A              | 42.4                              | 44.10                                    | 122                                | 138.6                                     |
|                | 1B              | 46.02                             |  | 157                                |   |
|                | 1C              | 43.9                              |  | 137                                |   |
| Arah serat 45° | 2A              | 47.5                              | 47.19                                    | 172                                | 168.6                                     |
|                | 2B              | 46.02                             |  | 157                                |   |
|                | 2C              | 48.06                             |  | 177                                |   |
| Arah serat 90° | 3A              | 46.02                             | 46.34                                    | 157                                | 160.3                                     |
|                | 3B              | 47.5                              |  | 172                                |   |
|                | 3C              | 45.5                              |  | 152                                |   |
| Nyglass fibre  | 4A              | 43.9                              | 42.93                                    | 137                                | 127.1                                     |
|                | 4B              | 42.4                              |  | 122                                |   |
|                | 4C              | 42.5                              |  | 122.5                              |   |

# RESULT OF FLEXURE TEST

- Composition of fibre with  $45^\circ$  : matrix = 80 : 20
- 4 layers

| Jenis Komposit | No Spesimen | Maksimum Strain<br>Nilai Kelenturan<br>(%) | Modulus of<br>Rupture (MoR) /<br>Nilai Patahan (N/<br>mm <sup>2</sup> ) | Maksimum<br>Force (N) |
|----------------|-------------|--|---|-----------------------|
| Serat 45°      | E 45 1      | 2.75653                                    | 20.2013   | 128.125               |
|                | E 45 2      | 5.52325                                    | 21.9643   | 120.313               |
|                | E 45 3      | 3.52984                                    | 23.4091   | 117.188               |
|                | E 45 4      | 4.06293                                    | 23.7069   | 129.688               |
|                | E 45 5      | 5.77104                                    | 23.8955   | 151.563               |
|                | E 45 6      | 4.13012                                    | 25.6649   | 148.438               |
|                | E 45 7      | 3.32711                                    | 20.3639   | 142.188               |
|                | E 45 8      | 3.62162                                    | 23.3749   | 148.438               |
|                | E 45 9      | 3.97362                                    | 19.8024   | 148.438               |
|                | E 45 10     | 3.21202                                    | 24.2178   | 139.063               |
| Rerata         |             | 3.93828                                    | 82.698  | 178.125               |

# LAMINATING PROCESS OF SOCKET PROSTHESIS



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TERIMAKASIH