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Developing plantable algae shoes using seaweed fabrics for pregnant ladies

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Abstract
The research "Developing Plantable Algae Shoes Using Seaweed Fabrics for Pregnant Ladies" aims to create eco-friendly, comfortable footwear for pregnant women. The shoes are made from seaweed fabrics, providing a biodegradable alternative to conventional materials. The shoes plantable nature allows them to be planted for reforestation and carbon sequestration. It acknowledges the challenges in material development, bio-compatibility, and design, emphasizing the importance of interdisciplinary collaboration. The research aims to address fashion, functionality, and ecological concerns, benefiting both pregnant women and the environment.

Keywords: Seaweed fabrics, pregnant ladies, bauxite, zirconium, algae, biodegradable

1. Introduction
Algae are being used to generate fibers, finishes, and pigments for the textile sector. Algae bloom can give cellulose or proteins, as well as the species can synthesize non-petrochemical lipids in larval form. Alga Life, a Berlin and Israel-based start-up, is making quick progress in developing algae-based materials for the textile and clothing sectors. Another convenience is that silicone coatings are seldom required starters [1]. Power blasting can be used to apply the layer directly toward the existing surface. This makes the overall procedure faster and simpler, making it less expensive than alternative coatings. Silicone polymer can be used as a coating on textiles to improve performance ranging from water profess to liquid nitrogen protection [2]. These characteristics have the potential to be exceptionally valuable in commercial applications. The recyclability of footwear and how to cope with the massive amount of waste created are the two most pressing issues in the fast-changing fashion business. One of the primary challenges is the combination of various materials and components [3]. Shoes have long been used to protect our feet in our daily lives. It is naturally warm, making it probably more pleasant for ankles. Many cultures used shoes for outdoor use, which were initially made of animal hide and leather. During the nineteenth century, the first shoe for both men's and women's use was developed. Currently, shoes are becoming increasingly trendy in terms of fashion as well as haute couture. China was the first to discover plant-based algal fibers. It is not only made of algal fibers, but it is also more resistant to fire and 100 percent biodegradable than cotton. This fiber is easily harvested and is environmentally beneficial. This alginate fiber is utilized in fertilizers, compost, and tablet synthesis. The majority of North Asian countries consume algae as a food source (Nori sheets and sushi). It is high in iodine and contains important minerals for the human body. Non-recyclable footwear waste is currently the world's most serious problem, but algae-based fibers have naturally cellulosic qualities and high protein enrichment. In some pandemic conditions, most individuals cover themselves with protective clothing. However, many illnesses move to the feet. Many countries lack appropriate sewage disposal, and sickness is rampant. According to a poll, the majority of Americans discarded 400 metric tons of footwear. Regrettably, it is not recyclable or biodegradable. Assume that most countries produce footwear-hazardous sewage. The research indicates found a full set of chemically synthesized sneakers typically discharges 30 pounds of carbon dioxide. That's an enormous environmental impact for something like a commodity that does not require power or complex components. Shoes significantly contribute to the gas emitted by the textile manufacturing process [4].

Based on athe above valid reasons the researcher formulated the following objectives

1. To source the algae sheets and seaweed fabrics to develop algae shoes.
2. Apply silicone coating on the insole made out of algae sheets.
3. Select germinated windflower and marigold seeds for making the insole.
4. To coat the algae sheet using honeybee wax and zirconium for its hydrophobic nature and spray bauxite to decrease herbicides.
5. To construct the shoes and evaluate them by quality analysis.

The idea of developing plantable algae shoes for pregnant women is promising in terms of innovation, sustainability, and maternal well-being. These shoes combine eco-friendly materials with functional footwear, catering to the needs of both pregnant women and the environment. The primary material, seaweed fabrics, could reduce the environmental impact of traditional shoe manufacturing while providing a comfortable and supportive option. The plantable shoes could also contribute to reforestation efforts and carbon sequestration when planted after use, aligning with global concerns about climate change.

However, there are challenges to overcome, such as material durability, biome compatibility, and the feasibility of planting. Designing footwear that meets the specific needs of pregnant women requires thorough research and testing. Collaboration between experts in fields such as fashion design, material science, botany, and sustainable engineering is crucial for the success of this venture. Regulatory and safety standards must also be met to ensure the shoes are safe for both wearers and the environment. While the concept of plantable algae shoes for pregnant women is intriguing, further research, development, and collaboration are needed to turn this concept into a practical and impactful reality.

2. Materials and Methods

2.1 Selection of sample

Before selecting a sample is a ascertain, it's a decision to prepare prototypes. First of all, illustrate prototypes and make some standard proportions of the sample. Analyze the standards of shoes and ideas of deceitful ways [5]. For this study, the development of a plantable algae shoe was carried out after a discussion with the wearer [6]. Then the investigator decides which uppercase and sole to choose, raw materials, seeds, finishing, etc. It is crucial to determine an exact measurement of five pregnant women who needed to build plantable shoes with algae sheets had their toe circumferences measured individually and the most suited pair was carefully selected bunion ligaments particularly the portion of the foot that they lay on [7]. Seaweed fabric was chosen for the uppercase materials, and it was obtained from the Synzenbe Company. Then it has a water-repellent coating and a soil-release finish. The primary components of the algae shoe are a shaft, which is the upper part of the shoe, and a base, which is the lower half of the boots. These are paired with numerous tiny reinforcements and rubber in this shoe [8].

Fig 1: Binding of uppercase

2.2 Preparation of the insole part of shoes

A selection of algal sheets was utilized to create insoles for expectant women; the lower portion of the insoles had a silicone coating for its hydrophobic nature, and five seeds of marigold, dahlia, windflower, wildflower, and zinnia were used to create plantable insoles. Clean and shiny shoes represent class and care, whereas dirty shoes represent untidiness and skin irritation [9]. For this experiment, it is critical to care for the zirconium that directly penetrates through algae sheets to resist heat and corrosion [10]. Zirconium and algae sheets have instant advantages for walking. The algae soles have the potential to be efficient water repellent when spraying bauxite. Place the screen on top of the upper insole and felt layers, then sprinkle some seeds on top of the silicone covering and gently massage into the insole surface [11]. The algae layer of honey bee wax will dry in a few hours. (The seeds will be at the bottom.) The tiniest seeds are desired while creating algae-based insoles. Specifically, the smallest seeds such as spinach and zinna seeds mixed, or even micro vegetal seeds would all work [12].

Fig 2: Insole Preparation

2.3 Finishing of shoes

The finishing of a shoe is a crucial personal item. Alginate fibers and algae sheet materials are used to cover the bottom case structure of the sole, which is joined to the lower section of the shaft [13]. The plantable algae shoe exists to protect the user from damage [14]. Don't let your feet touch the surface while constructing this shoe; hang them in sheets of algae [15]. (Between 3 and 5 days).

Fig 3A: Casting process

Fig 3B: Shaft and base preparation

2.4 Physical evaluation of seaweed fabric

When compared to cotton, the cellulosic fabric exhibited several qualities. However, this alginate fiber has certain unique attributes due to its relatively low density [16]. Some of the key tests are examined using proper procedures. This testing accomplishes standard procedures.

Table 2: Evaluation

S. No	Testing	Results
1	Fabric Thickness Test	0.26 mm
2	Fabric stiffness Test	Warp =1.21 cm Weft = 0.75 cm
3	Crease recovery	Warp =54.2 degree Weft =58 degree
4	Tearing strength	Warp = 4198.4 grams Weft = 4172.8 grams
5	Color fastness to rubbing	Dry rubbing = Mode -3 Wet rubbing =Mode -1

2.5 Wear study

The built plantable algae shoes had been delivered to five pregnant women in their third trimester for wear testing. They were required to wear them for seven straight hours throughout respective core hours. The survey was structured to ascertain the wearer's comfort, ease of removal, and pressure on the toes, among other things. After seven days, the wearer was asked to complete a questionnaire. The wearer's data was aggregated, tallied, and discussed in the result and discussion.

The contact of ankle insoles with the environment is finely compactable and the wearing surface is frictionally fortified without interruption [17]. Both its porosity and sweatiness are good.

Fig 4: Wear Study

3. Results and Discussions

All the plantable algae shoe samples were evaluated by five pregnant working women at the primary health center in Omalur, Tamil Nadu. The following criteria are evaluated;

3.1 Comfort ness of plantable algae shoes

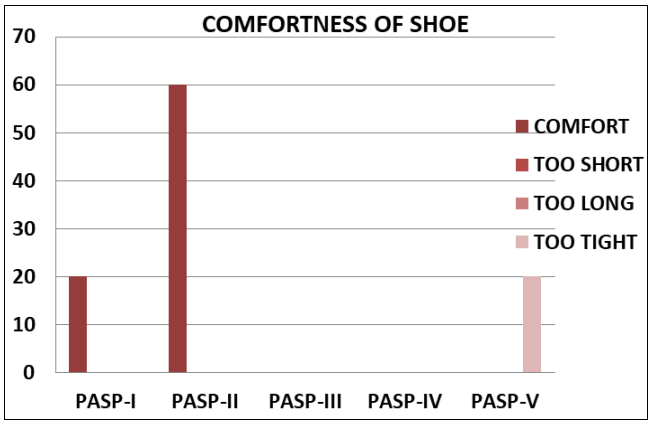

Fig 5: Comfort ness properties

Figure 5 shows that, out of five replies, 80 percent of respondents thought the algae shoe was pleasant to wear. Only 20% of responders wore it together because it was too tight owing to the unusual form of her ankles.

3.3 Pressure on toes while wearing

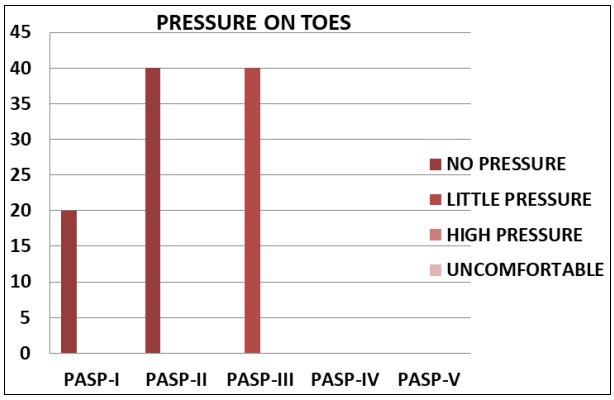

Fig 6: Pressure on wearers' bunion

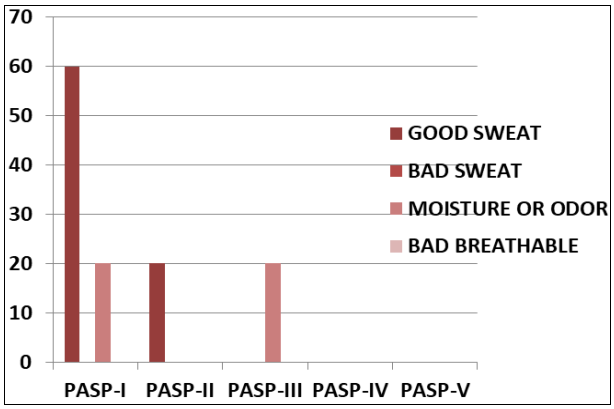

Fig 7: Moisture and odor resistance

It is simple to see from Figure 6 that, out of 5 user replies, 60% believed the algae shoe provided no pressure to the wearer. Only 40% of respondents thought there was minimal pressure on the wearer's bunion when walking.

3.4 Moisture and odor resistance

From Figure 7, It is evident that, out of five wearers, 80% of the respondent felt the algae shoe was good to sweat–absorbent and has breathable performance.

Figure 10 illustrates that, out of five wearers, 80% of respondents thought the microalgae shoe was sweat-absorbent and breathable. Only 20 percent of the responders believed it has moisture and odor resistance to users owing to pregnant ladies' shoes' strong disagreeable odor. Each shoe contains 1250,000 moisture-extruded glands on the foot. However, these shoes stink and develop germs and microorganisms.

3.5 Plantable algae shoes are sustainable

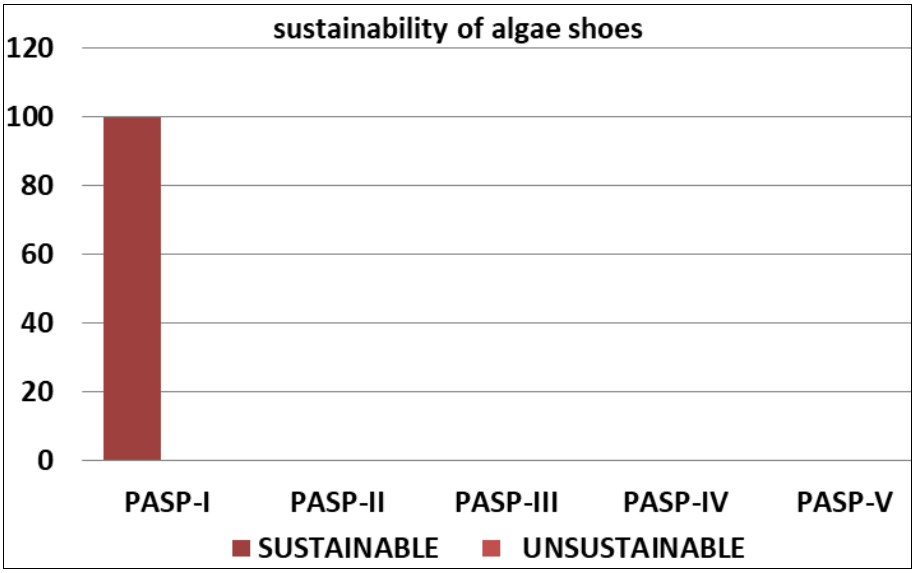

Fig 8: Sustainability

Figure 8 shows that, out of five replies, all wearers thought the algae shoe was sustainable.

3.6 Suitability of Shoe width

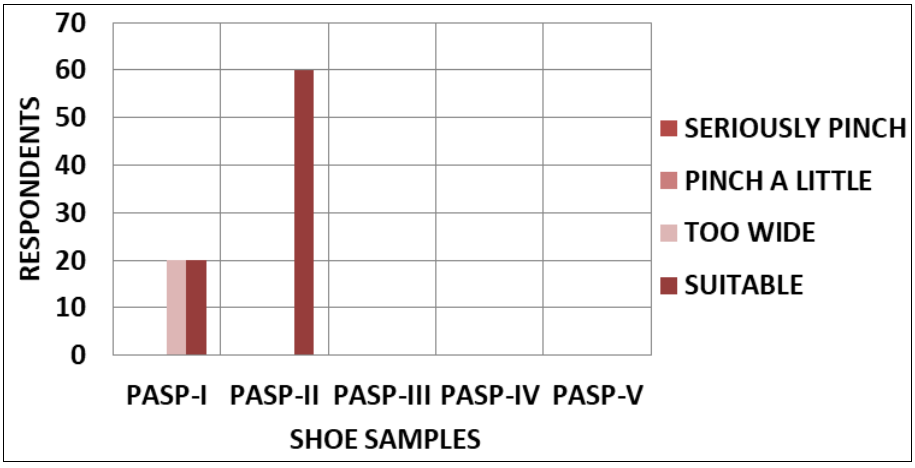

Fig 9: Suitability

Figure 9 demonstrates that, out of five wearer comments, 80 percent thought the chosen shoe width was appropriate for the wearer. Only 20% of respondents said it was too large to wear because her feet moved back and forth or from side to side during her stroll [18].

3.7 SEM Analysis

The seaweed fabric range of metal content is sorted out where the quality starts to fluctuate as a visible spectral change of shade and fixation rate of molecules has been found. Na plays an important role in functions such as muscle contraction. Nerve impulse generation and fluid balance. Magnesium (Mg) reduces sweating properties. The lack of oxygen leads to cell death. Muscle fatigue occurs when the intensity of the activity is high due to getting enough metabolism for pregnant women. Calcium (Cl) maintains a strong role in muscle function and various other physiological processes in the human body. Attributed to the reason that women 's footwear stinks even though female soles possess 250,000 sebaceous glands that are constrained in a shoe, the perspiration and warmth provide breeding habitat for microorganisms [19]. Causing their feet to drift back and forth or from side to side when walking [20]. According to the investigation, the entire sample was completely sustainable and biodegradable [21]. Due to bunion swelling during the trimester of pregnancy, this may be extremely advantageous for pregnant women [22].

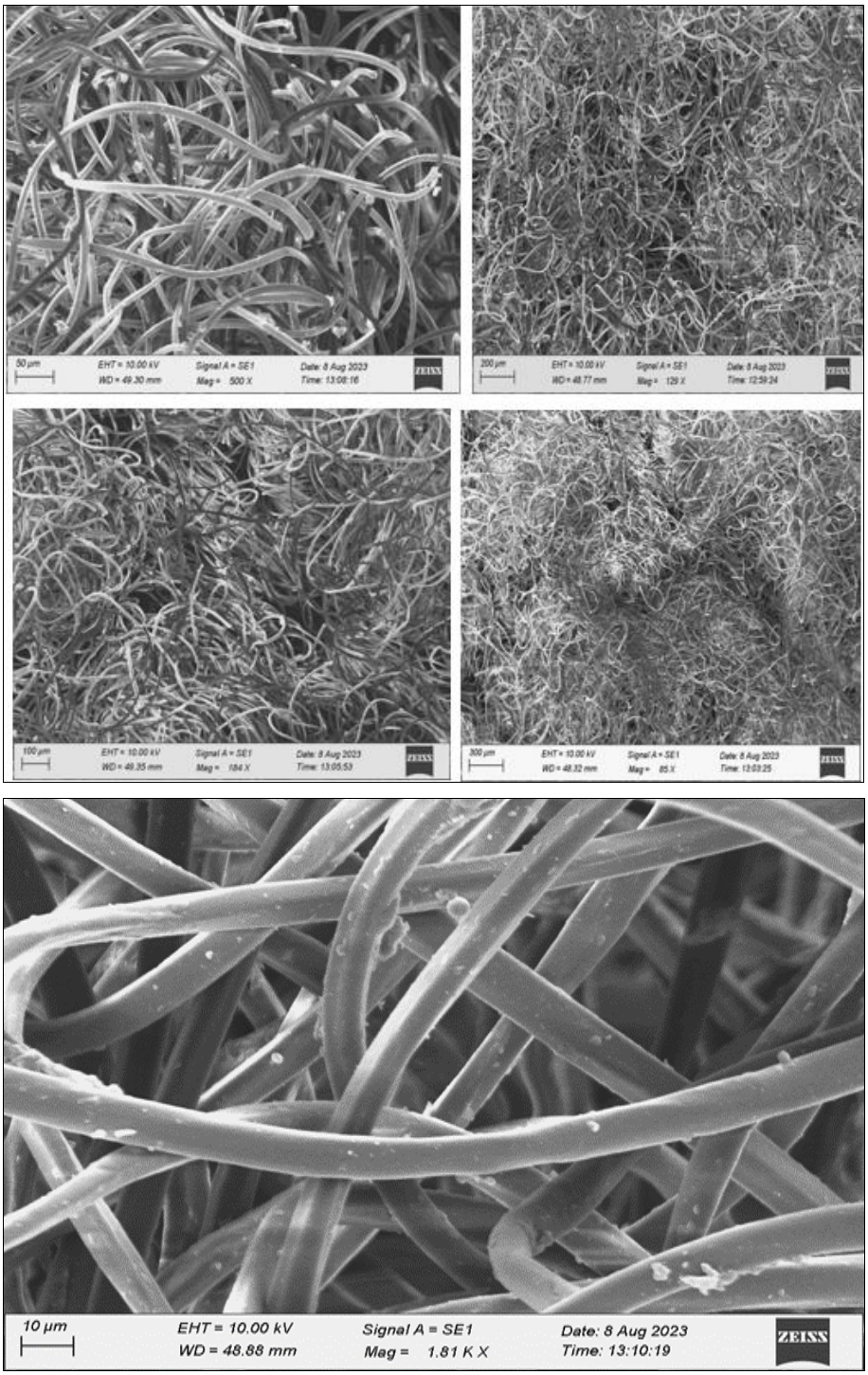

Fig 10: SEM images of Seaweed fabric

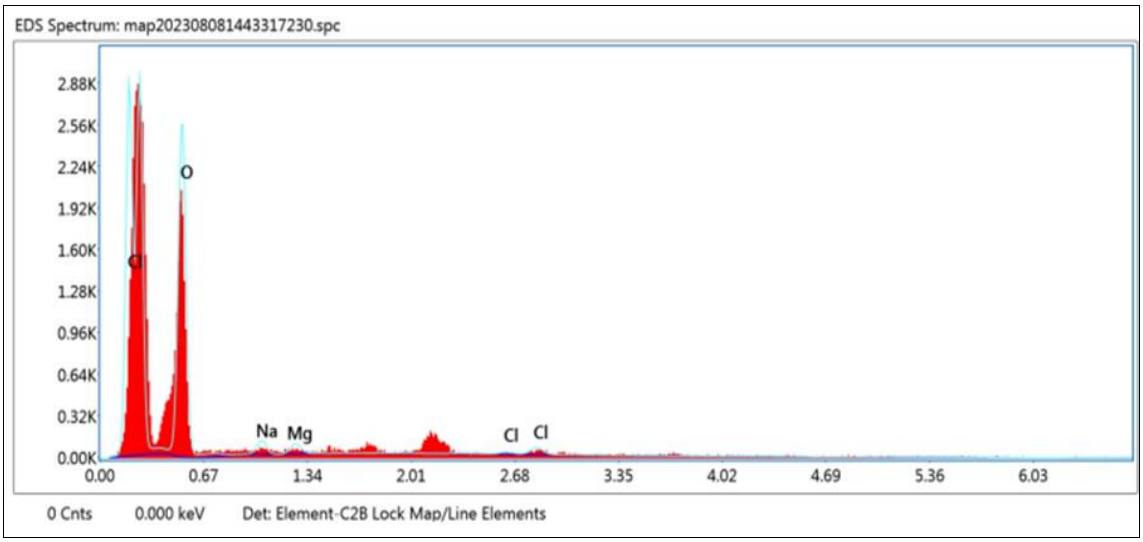

Fig 11: EDS Spectrum

Table 3: Smart Quantum Results

Element	Weight %	Atomic %	Net int.	Error %	Kratio	Z	A	F
OK	84.55	89.40	195.41	3.80	0.7801	1.0172	0.9070	1.0000
NaK	8.34	6.14	9.10	13.77	0.0479	0.9105	0.6308	1.0012
MgK	4.88	3.39	6.99	14.58	0.0327	0.9224	0.7265	1.0011
ClK	2.24	1.07	1.93	24.20	0.0184	0.8312	0.9790	1.0096

4. Conclusion

The development of plantable algae shoes using seaweed fabrics for pregnant women offers a sustainable and innovative solution. These shoes, made from eco-friendly materials, could reduce the environmental impact of traditional shoe manufacturing while providing comfort and support. They also contribute to reforestation efforts and carbon sequestration when planted, aligning with global concerns about climate change and the need for creative solutions.

5. Conflict of Interest

The authors declare that they have no conflict of interest.

6. Acknowledgment

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