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Versatility of the humble seaweed in biomanufacturing

Jae-Llane Ditchburn and Carlos Brais Carballeira

4-5 October (2018)

Tirgu Mures, Romania

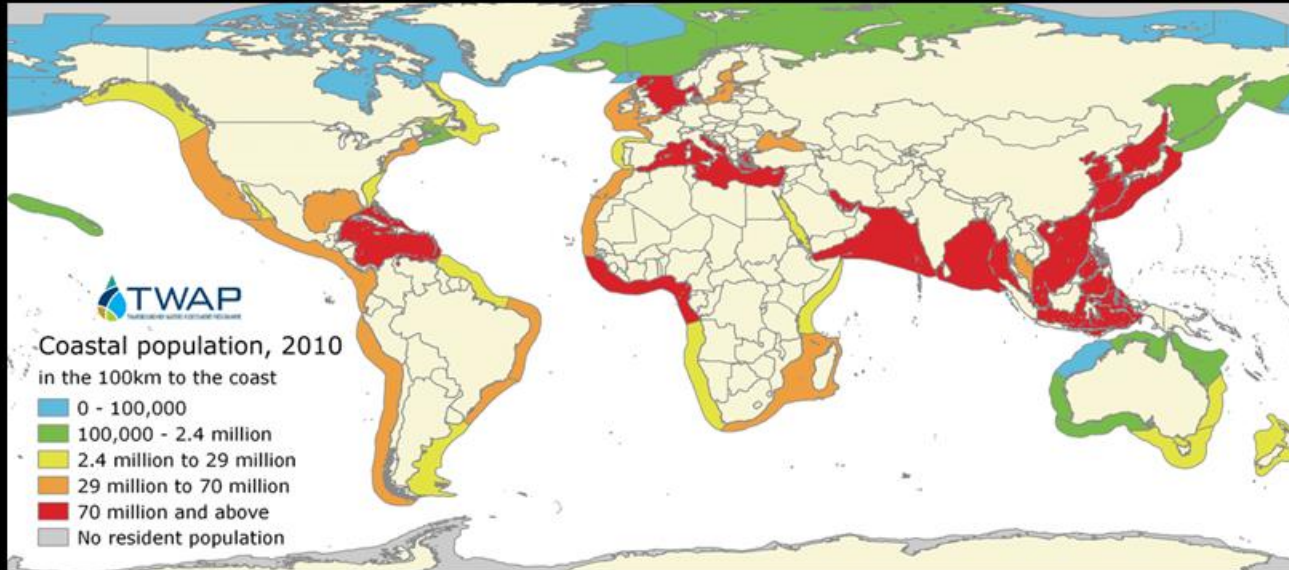
The 12th International Conference Interdisciplinarity in Engineering

Seaweed

- Types: Green, Brown and Red
- Diverse biological characteristics
- May grow in diverse environments



Sustainability



- More than half of population lives at the coast (<100 km)
- 71% of world surface belongs to the oceans
- Macroalgae cultures bioremediate organic contamination
- Macroalgae may be later used to produce biofuels, bioplastics, food, medicines...



Uses in biomanufacturing

- FOOD
- ENERGY
- HEALTH
- MATERIALS

Direct use of a seaweed

Bioremediation

Bioindication

Aquaculture

Fertilizer and soil
conditioners

Animal
feed

Biological and chemical transformation

Medicines and
pharmaceuticals

Cosmetic
industry

Food and
edible items

Bioengineering

Biofuels

Bioenergy

Bioplastics

Bionanotechnology

Byproducts

ENVIRONMENT

- Fertilizers
- Soil conditioners
- Aquaculture

Eutrophication control
Antifungal
Water footprint
Climate change

NUTRITION

Antioxidant
Nutritional benefits
Healthcare
Immunity enhancement

- Food supplements
- Feed additives
- Animal
- Cosmetics

Extracts from Seaweed

Polysaccharides
Proteins
Polyphenols
Pigments
Conjugated fatty acids

- Medicines
- Biomedical parts

MEDICINE

Antimicrobial
Antiviral
Anti-inflammatory
Anticoagulant
Anticancer
Anti-allergy

FUELS & BIO-MATERIALS

- Bio-crude
- Bio-char
- Bio-gas
- Bio-plastics
- Bio-nanoparticles

Renewable energy
Eco-friendly fuels
Biodegradable waste

Bioplastics



- Similar characteristics to those obtained from crude (properties and fabrication)
- Biodegradable and renewability (Environmentally friendlier)
- No toxicity at human feeding activities neither implantable materials
- More resistant to microwave radiation, less brittle and durable
- PHA and PHB are green substitutes of polypropylene



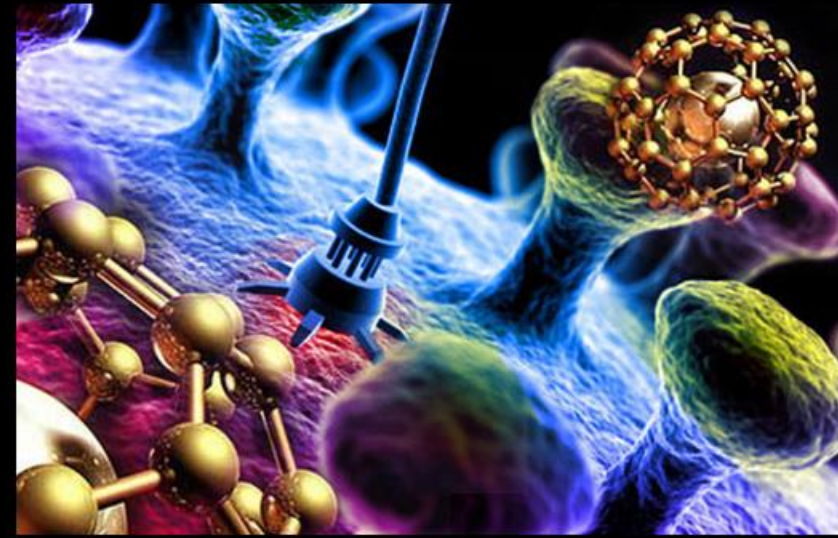
Biofuels

- Advantages compared to terrestrial plants
 - efficiency on photosynthesis
 - no competition for habitat
 - reduction in eutrophication and toxicity
 - easier production
 - higher methanogenic potential and EROI (energy return of investment)
- Bio-crude and bio-chars with high energy output
- Energy produced by direct combustion is more efficient than coal power plant



Bionanotechnology

- Mediation of synthesis of metal Nanoparticles
- Metal nanoparticles (Ag, Au, Fe and Pt)
- Metal oxide nanoparticles (Cu, Zn and Fe oxides)
- Biosynthesis is still not well understood



Conclusions

- Accelerated growth, regeneration and easy cultivation
- Address global environmental issues and avoid competition with other land activities
- Numerous natural properties and bioactive compounds
 - Treat cancer
 - Power engines
 - Biodegradable plastics
 - ...
- However, further research on biomanufacturing processes is needed to develop competitive, healthy and more sustainable methods



Thank you!