

Integrated approach on energy management, treatment and reuse of industrial wastewater for sustainable agricultural development – A green food security concept.

Dr. Singanan Malairajan , M.Sc., Ph.D.,

**Water and Food Chemistry Research Laboratory
PG and Research Dept. of Chemistry
Presidency College (Autonomous)
Chennai – 600005, Tamil Nadu, INDIA.
Email: msinganan@yahoo.com**



PAUWES

**RESEARCH 2 PRACTICE
FORUM 2018**

**ENERGY, WATER SECURITY
AND CLIMATE CHANGE IN AFRICA**

**16th - 18th APRIL, 2018
TLEMEN, ALGERIA**



Supported by:

giz



DAAD



My Institution



- **Presidency College (Autonomous), Chennai.**
- **Affiliated to Madras University.**
- **Established in the year 1840.**
- **Housing 27 Teaching and Research Departments.**
- **Department of Chemistry is established in the year 1857.**
- **Offering B.Sc., M.Sc, M.Phil., and Ph.D programs.**
- **23 Faculty members with distinct specializations.**
- **139 Ph.D and 3 D.Sc degrees are awarded.**



Introduction

- The water-food-energy-climate nexus are emerging as an important and vital issue for the sustainable development in our society.
- The quality and quantity of fresh water is of vital concern for mankind since it is directly linked with human welfare and settlements.
- Increasing demand for food, fiber and fodder will put great strains on land, water, energy and other resources. This is also greatly impacts on climate change.
- The population growth, urbanization, modernization activities, demand and supply are ultimately accelerating the increased generation of solid wastes and large quantities wastewater from industrial and domestic sectors.
- It is also causing over exploitation of available fresh water resources and leading to grater water scarcity and pollution.

Importance of the research

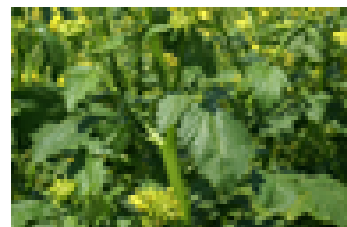
- Wastewaters, regardless of their type, are a serious problem in both environmental and economic perspective.
- On the other hand, it can be viewed as a potential resource not just for water but as energy and nutrient resource.
- The energy potential of wastewater is ten times more than the energy used to treat it.
- Safe disposal of wastewater is essential which should not pose any threat to human life or health and the environment.
- Hence, proper wastewater management is of great importance in achieving sustainable development.
- Most of the conventional methods are environmentally unfriendly and also technically complicated processes.
- Adsorption is a simple process, can remove both soluble and insoluble pollutants with a high removal capacity.

Current Research

- In the current investigation, we introduced a new biocarbon which is generated from a plant called **Brown mustard** (*Brassica juncea*) .
- The characteristics of the biocarbon is unique and having good potential for the removal of salts and organic components in water and wastewater.
- The treated textile (CETP) wastewater is used for the growth of fodder grass in a pilot project and its performance is evaluated.

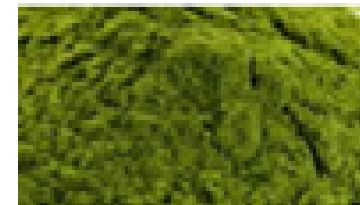
Methodology

Process of biocarbon preparation



Brown mustard
(*Brassica juncea*)

Drying and Grinding

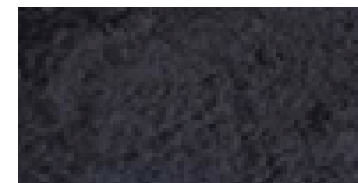
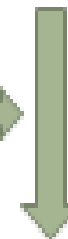


Green Powder

Con. Sulphuric acid
Activation Process



Exothermic/
Carbonizing



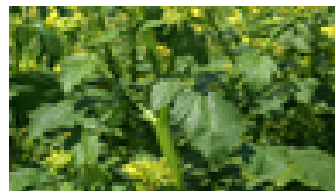
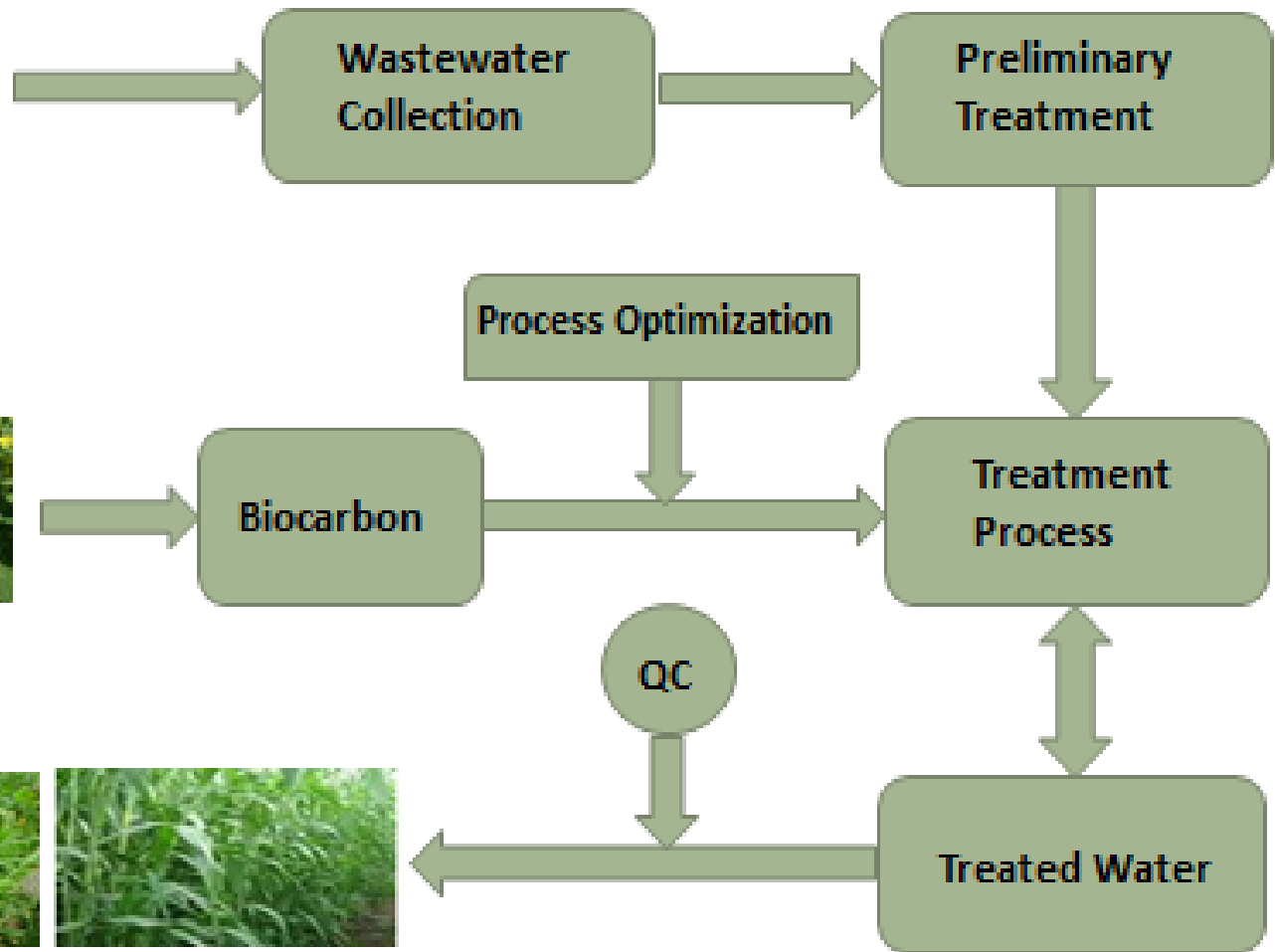
Distilled water washing/
Drying at 110 °C



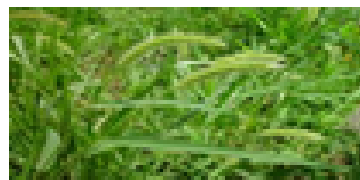
Biocarbon



Wastewater Treatment Process



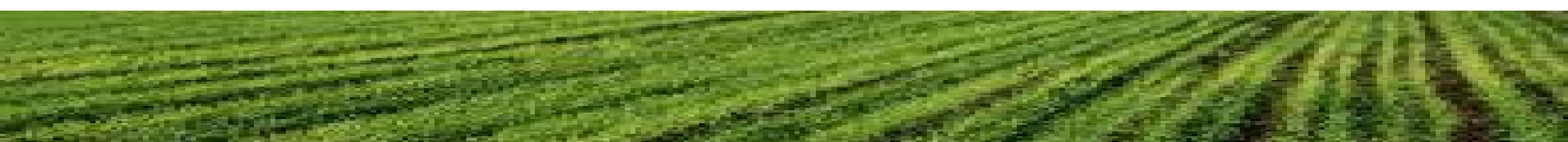
Brown mustard
(*Brassica juncea*)



Setaria glauca



Sorghum



Results and discussion

Characteristics of grey water and treated water

S.No.	Characteristics of grey water	Quality of grey water (mg/L)		Percent Reduction
		Before treatment	After treatment	
1.	pH	8.5	6.7	21.17
2.	EC ($\mu\text{mhos/cm}$)	2080	485	76.68
3.	Alkalinity	955	275	71.20
4.	Suspended solids	1125	220	80.44
5.	Total dissolved solids	1350	315	76.66
6.	Dissolved oxygen	4.2	5.8	--
7.	Total nitrogen	145	35	75.86
8.	Total phosphorous	120	30	75.00
9.	BOD	640	120	81.25
10.	COD	1800	360	80.00

Growth characteristics of selected farming crops

S.No	Parameters	Setaria glauca	Sorghum
1.	Field size	12 x 12 Sq.ft	12 x 12 Sq.ft
2.	Growth period	120 days	120 days
3.	Total biomass	3.0 - 4.0 Kg/ Sq.ft	3.0 - 4.0 Kg/ Sq.ft



Conclusions

- The biocarbon technology is an efficient and economically sound technology for the treatment of industrial grey water and does not produce any major secondary effluent and sludge.
- The treated water can be reused for various purposes in industries as well as in agricultural development.
- In the present pilot scale study, the yield of fodder grass *Setaria glauca* and *Sorghum* is confirmed as good.
- Further revealed that the biocarbon treated wastewater is much useful for irrigation for cultivation of plants by reuse technology and impose to save the environment from pollution causing agents.
- It is further recommend that, with proper legislations with relevance to treatment and reuse of wastewater systems, this technology can be extended to large scale irrigation project for sustainable food productions.

Possible areas of Cooperation with PAUWES

As researchers or practitioners what are the possible interactions/collaboration with practitioners resp. researchers to improve/upscale your activities

Intergrated water and wastewater treatment process.

Reuse of treated water in suatainable agriculture.

Water reources management.



What are the potential aspects of the research that can be transformed into practice?

- ▶ **Water and wastewater treatment with novel technology is our current focus.**
- ▶ **It a start from laboratory to field.**
- ▶ **The out come of the basic research should be transformed into action.**
- ▶ **Transfer of tehcnology developed to common man use.**
- ▶ **We need suitable international collaboration to achive all the goals.**

Acknowledgement

- R2P Conference chair and Technical Committee.



Thank You!