

Phytoremediation crops for sustainable biofuels: Scope and limitations



NL Agency
Ministry of Economic Affairs



WAGENINGEN UR
For quality of life

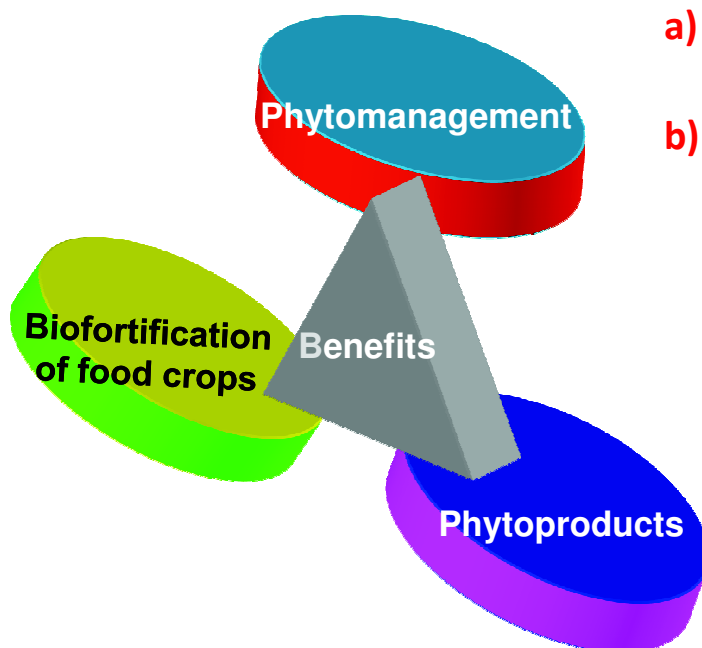


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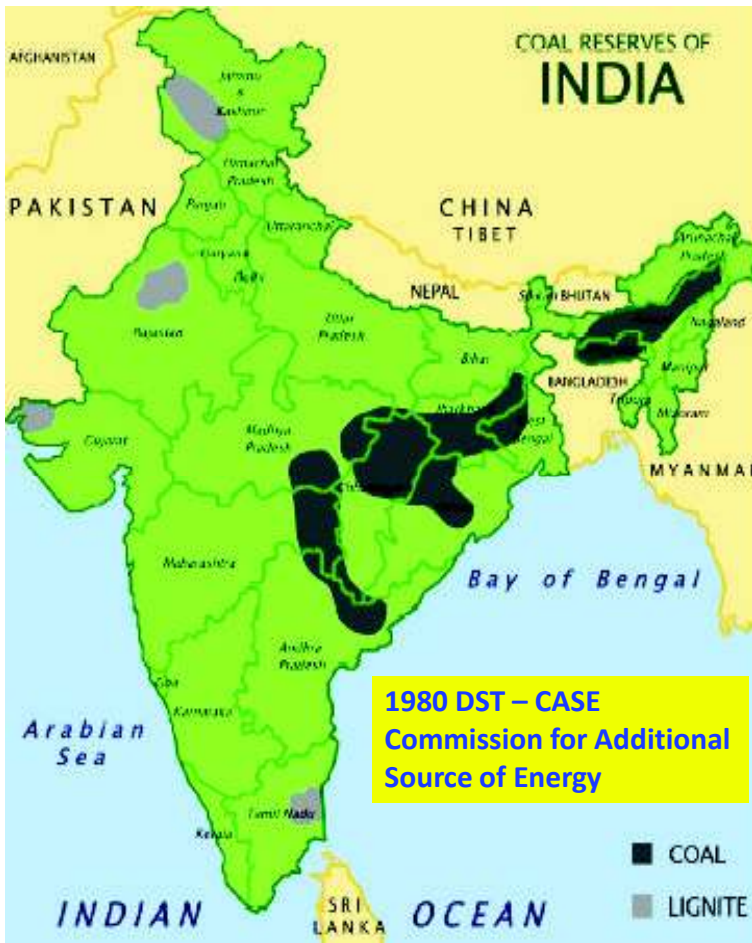
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Benefits of plants used in phytomanagement, provided fast growing with high bioproductivity



- Globally Land Resources are under immense pressure
- The pressure on available land resources is also increasing because:
 - Land degradation
 - Population explosion
 - Global Economic Development
 - Urbanization

This presentation will focus on usage of contaminated land and water [waste water] for sustainable biofuels



Sunflower- Environmental Crop- Abundant biomass
Trace element accumulation including radionuclides

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Use of chelators viz., EDTA, NTA and FYM foster metal accumulation

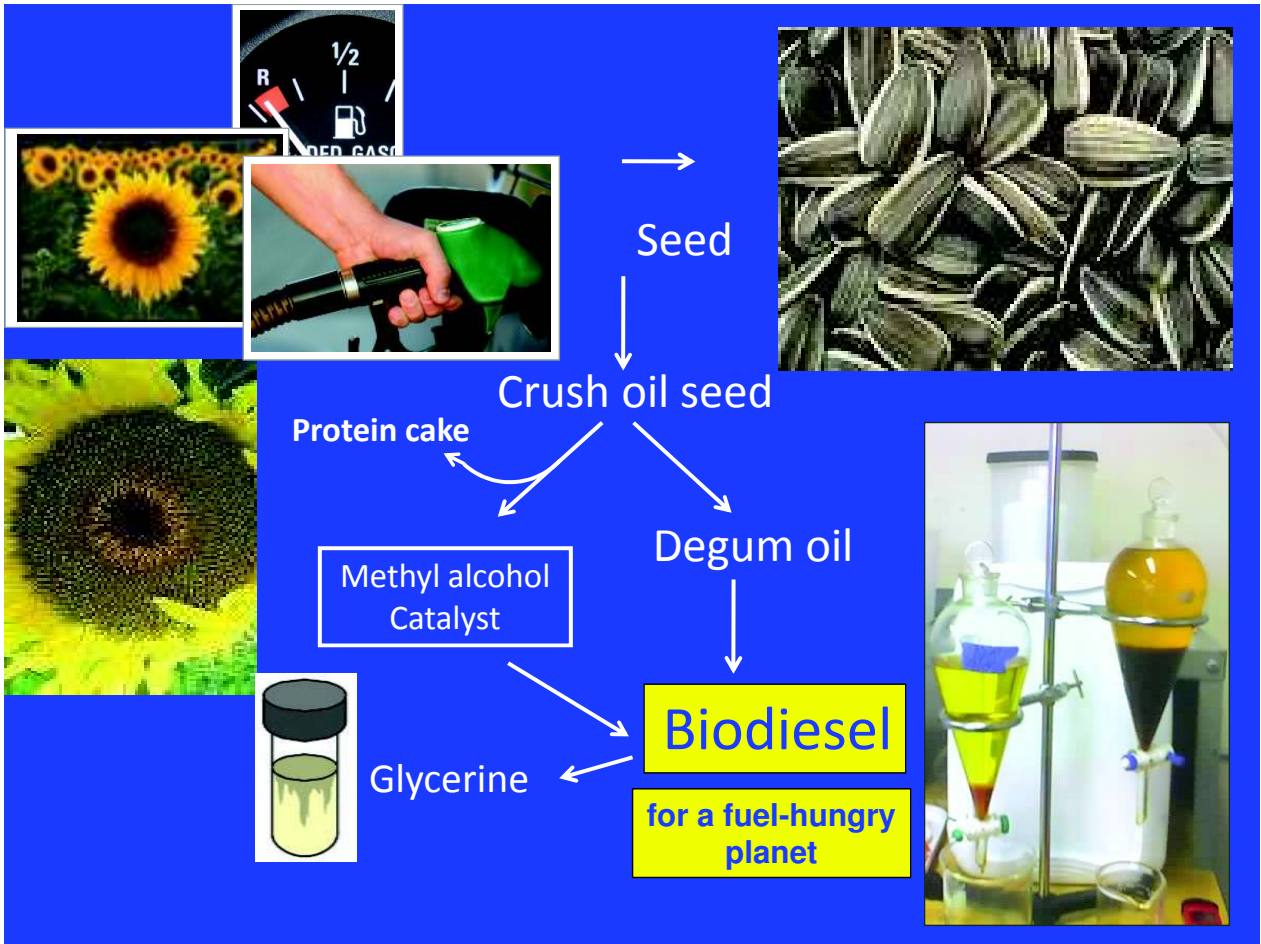
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Harvesting & Crop rotation

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Biodiesel, Fiber and and industrail feed stock

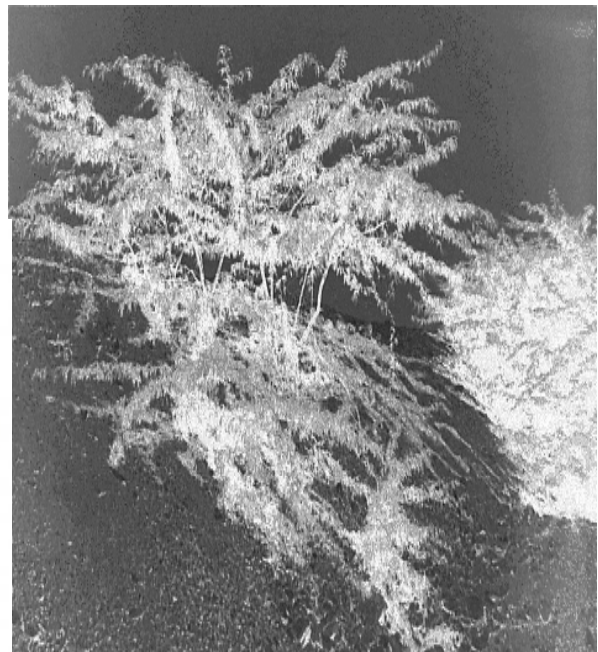
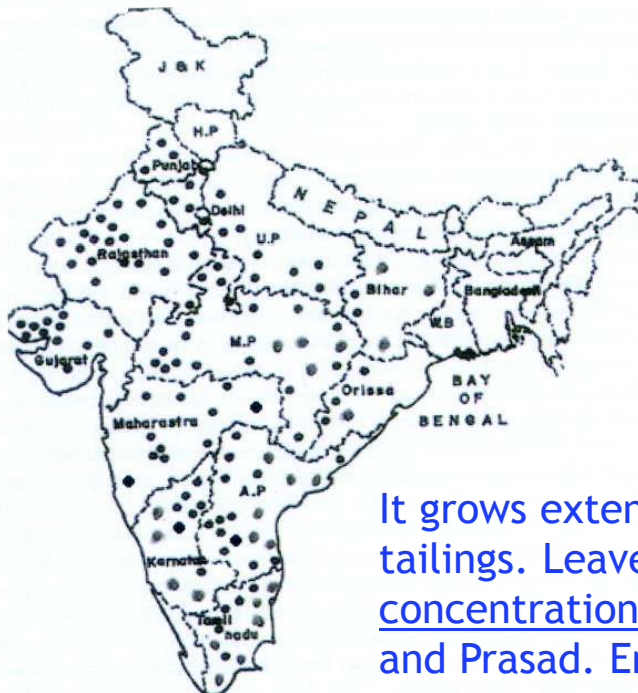




This block contains a collage of images and a diagram related to biofuels and environmental remediation. On the left, there are images of a sunflower field, a red barn, and a bus labeled 'BIODIESEL'. On the right, there is a 'BIOFUEL' logo and a diagram of a plant's root system in soil. The diagram shows the plant's roots absorbing various pollutants from the soil, labeled as U, TCE, PCB, TPH, BTEX, and TNT.



**Distribution of
Prosopis juliflora in India**



It grows extensively on the pegmatitic tailings. Leaves and twigs accumulated large concentrations of Sr, B, and Ba. Nagaraju and Prasad. *Envir Geol* 36: 320-324, 1998



Charcoal increased soil microbes (PGPR) in the fields



Gumgaon, Manganese Mine in Central India – Vegetative Capping by Bamboo



Bamboo Charcoal powder for removal of heavy metals

☞ The use of activated charcoal is considered to be the best currently available technology for removing low-solubility contaminants in water treatment.

☞ Operational cost is low.

☞ Therefore, *Melocanna baccifera* raw charcoal (MBRC) and *Melocanna baccifera* activated charcoal (MBAC) were evaluated as adsorbents for the removal of heavy metals such as Pb, Cd, Ni, Zn and Cu from aqueous solutions through biosorption.



Charcoal kiln

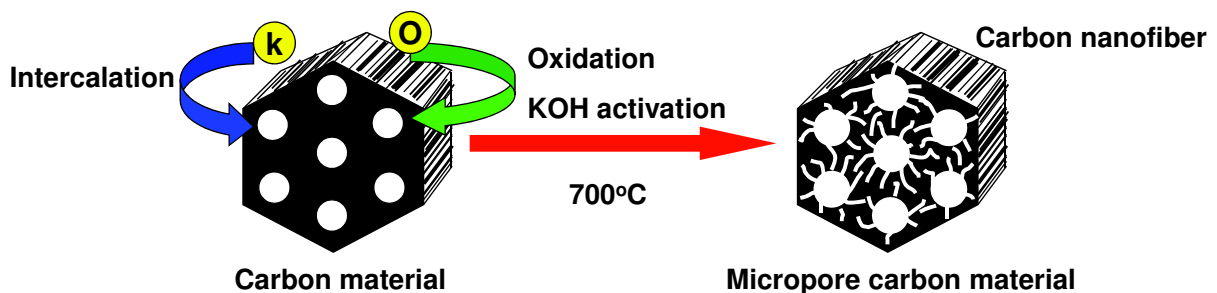


Bamboo charcoal



H. Lalhruaitluanga, M.N.V. Prasad, K. Radha, (2011) Potential of chemically activated and raw charcoals of *Melocanna baccifera* for removal of Ni(II) and Zn(II) from aqueous solutions. *Desalination* 271 301-308.

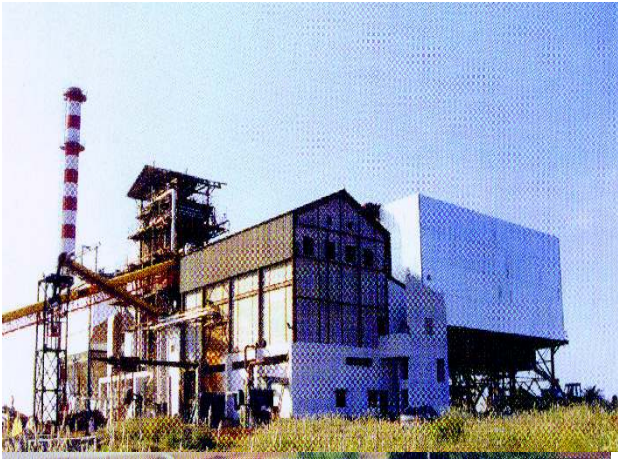
H. Lalhruaitluanga, K. Jayaram, M.N.V. Prasad, (2010) Comparative study of raw and activated charcoals of *Melocanna baccifera* Roxburgh (bamboo) as an adsorbent for the removal of lead(II) from aqueous solution. *Journal of Hazardous Materials* 175 311-318.

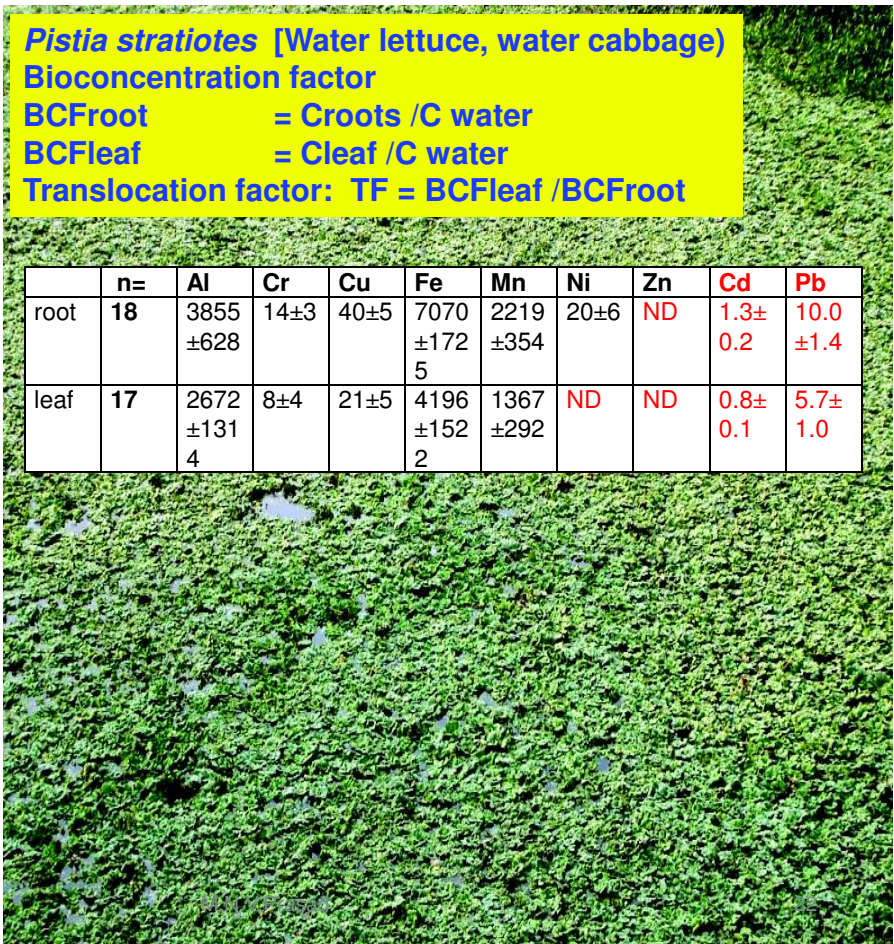


Pictorial representation of the formation of micropores in the carbon upon activation with KOH









***Pistia stratiotes* [Water lettuce, water cabbage]**

Bioconcentration factor

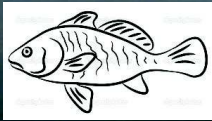
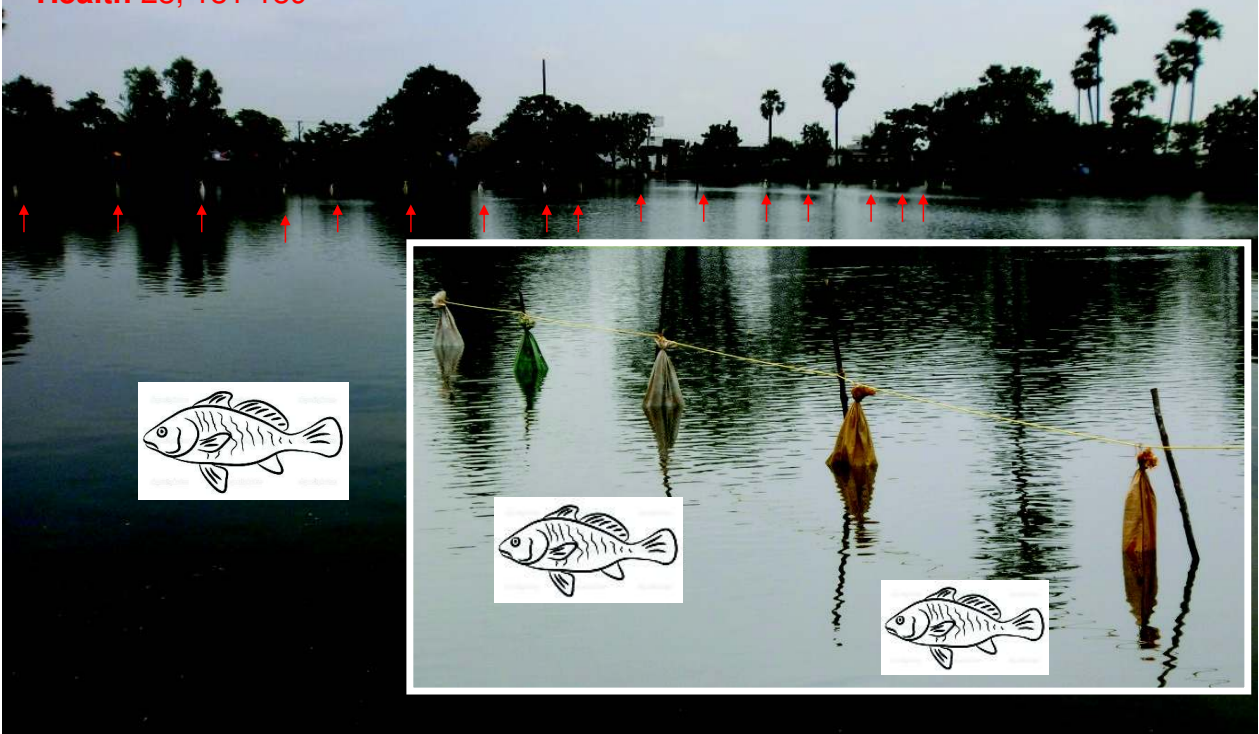
BC_{Root} = C_{Roots} / C_{water}

BC_{Leaf} = C_{Leaf} / C_{water}

Translocation factor: TF = BC_{Leaf} / BC_{Root}

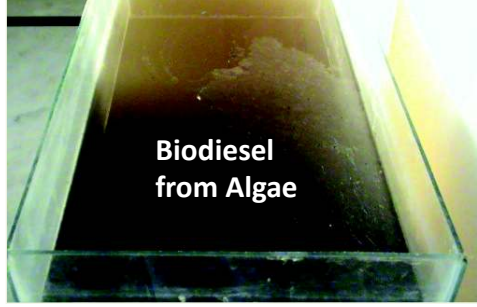
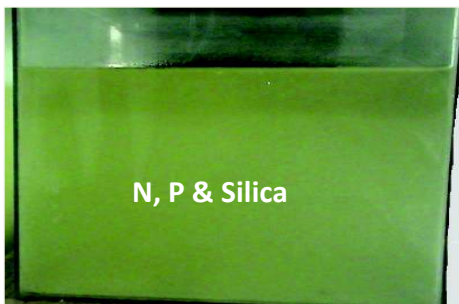
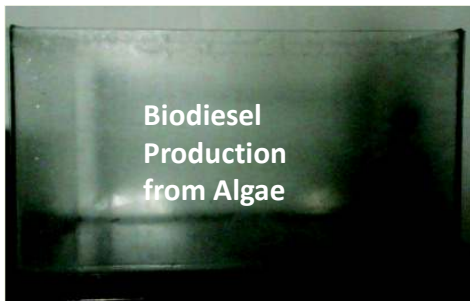
	n=	Al	Cr	Cu	Fe	Mn	Ni	Zn	Cd	Pb
root	18	3855 ±628	14±3	40±5	7070 ±172 5	2219 ±354	20±6	ND	1.3± 0.2	10.0 ±1.4
leaf	17	2672 ±131 4	8±4	21±5	4196 ±152 2	1367 ±292	ND	ND	0.8± 0.1	5.7± 1.0

Prasad M.N.V. & Rajendra Prasad (2012) Nature's cure for cleanup of contaminated environment – a review of bioremediation strategies. **Reviews on Environmental Health** 28, 181-189



After harvesting *Pistia stratiotes* the water body is used for fish culture – red arrows show feed bags suspended with rope across the water body

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47 *phoomdi* species, viz. 10 medicinal, 14 wild edibles, 1 fodder, 1 related with culture, 4 house making material, Biofuel and 17 multipurpose applications







Floriculture