

## SOME POSSIBLE USES OF WATER HYACINTH

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Water hyacinth (*Eichhornia crassipes*) is, in many ways, the most important of the floating aquatic weeds native to tropical South America.

Other floating weeds native to Central and South America include another *Eichhornia* species (*E. azurea*), *Pistia stratiotes*, *Azolla caroliniana* and species of *Salvinia*.

*E. crassipes*, *E. azurea* and *Pistia stratiotes* usually reproduce asexually although they, also, do reproduce sexually; which is of importance for spreading into new areas or those, where clearing has already been carried out. Water hyacinth has a rapid rate of proliferation and, depending on conditions, may double in anything from 6 days or more.

Over the years, water hyacinth has become widespread in other continents and over fifty two countries in the tropics and is often thought to constitute a major "nuisance", where it occurs. Attempts to "control" it have usually taken the form of mechanical clearing or spraying with herbicides. Insufficient emphasis has been given to biological control methods or on gainfully utilizing water hyacinth. Work has often been experimental in nature and, though the results have been promising, insufficient action has been taken in many countries including Sri Lanka to translate them into practical use. The present article attempts to no more than indicate some directions in which work has been progressing with this aquatic plant, in finding uses for it.

### Some Uses of Water Hyacinth

#### a) Improvement of quality of polluted waters

Water pollution is frequently due to human sewage, animal manure and chemicals used as agricultural

fertilisers. Although these sources of pollution contain a variety of chemicals, it is principally the content of assimilable nitrogen and phosphorus that results in eutrophication or the growth of the algae which gives green the colour which has developed, for example, in recent years in the Beira Lake in Colombo.

Another type of pollution of waters is that from industrial effluents. These effluents may contain metal ions, anions and organic compounds. Some of these may pose hazards to human health if present in quantities above certain levels.

Water hyacinth is now advocated in some parts of the world to improve the quality of water contaminated with sewage, animal manure, fertilizers and wastes from households and food processing plants. The waste water is released into shallow ponds in which water hyacinth is growing. The nitrogen and phosphorus content of the dilute waste water is reduced by the water hyacinth, part of which is harvested periodically to allow new growth to take place. It was shown during trials in Texas and Florida in the United States, that around twenty to forty tons (wet weight) of water hyacinth can be removed from each hectare of pond surface each day. This quantity is equivalent to the nitrogen content of the sewage of more than 2000 people and the phosphorus content of the sewage of more than 800 people.

Water hyacinth also has the capability of absorbing metal ions, such as magnesium, zinc, lead, mercury, nickel, chromium and cadmium, many anions and organic compounds. Some of these pollutants may reach levels, 4,000 to 20,000 fold concentrated in the plants than in the solution in which they are growing. While this is a valuable and relatively low-cost method of improving the quality of waste waters after initial treatment, care should be taken in the disposal

of water hyacinth containing toxic compounds. Similar precautions should, also, be taken in the disposal of water hyacinth, which may have come in contact with raw sewage as the root system may harbour pathogenic micro-organisms. It has been recommended that water hyacinth containing low levels of metal ions could be used as a raw material for the manufacture of boards.

#### b) Biogas production

Water hyacinth has been used as a raw material for biogas digesters. For this, it does not require dewatering, i.e. reducing the water content of freshly harvested plants. Studies by the National Aeronautic and Space Administration (NASA) of the U.S.A. indicated that using the water hyacinth from one hectare could result in the production of over 70,000 cu. metres of biogas.

One integrated scheme developed in Assam makes use of the roots to improve the soil, the petioles (leaf stalks) for paper manufacture and the remainder of the plant (rhizome, leaf and stolon) for biogas generation. The waste black liquor from the paper manufacturing process is also added to the biogas digester and the sludge from it is partially sun dried and sold as fertilizer. It was reported that the project was economically viable, although funds would have to be obtained to meet initial capital costs.

#### c) Paper and board

Early work on the possibility of using water hyacinth for the production of paper gave disappointing results. However considerable research efforts subsequently succeeded in improvements which indicated that water hyacinth could be used for the manufacture of certain grades of paper and board. The process would be economically viable if abundant supplies of the plant were available at no cost and close to the production plant.

For the production of paper, it has been found that the roots should be discarded as they are somewhat dark and stiff. The leaves are brittle and only the stalks should be used for the production of paper. However, the leaves could be added if desired for the

manufacture of certain paperboard products such as file covers, greeting cards, visiting cards and album papers. While bond or other high quality papers were not economically viable to produce from water hyacinth stalks, the characteristics of the pulp were satisfactory for the manufacture of grease proof paper. The water hyacinth pulp could also be blended with pulp from waste paper, bamboo, jute, rag etc., when necessary.

#### d) Livestock feed

While water hyacinth is not considered suitable as food for human consumption, research conducted overseas has indicated that it may be of value as a feed supplement for certain livestock. In some cases, such as cattle, buffalo and goats, it is beneficial to sun dry the water hyacinth in order to increase the nutrient content of the bulk consumed. Rabbits and pigs may be fed with fresh material as feed supplement. Experiments to examine whether leaf protein concentrate from water hyacinth can be used as a supplement in poultry feed have been reported to give encouraging results. However, fresh water hyacinth may not be suitable as a feed supplement for ducklings. In Malaysia, fresh water hyacinth is cooked and used as a feed supplement for pond fish.

The above are only indications of what has been achieved. Further experimentation under local conditions will be necessary to determine what is, in fact, achievable and economic. For instance, different methods of dewatering water hyacinth should be tried as sun drying may not be the optimal method in some areas.

Water hyacinth, growing in polluted waters should not be used for animal feed as the material may contain toxic pollutants. Also, it may be advisable to select the plants at the right stage of growth, e.g. tall-stemmed plants and to remove the roots. Water hyacinth with a high mineral content may, even if non-toxic, be unpalatable to livestock.

#### e) Soil improvement or use as compost or mulch

The roots of water hyacinth can be composted and tried out as a potting material for pot plants.

The various parts of the plant have been used in making compost for use as a cheap fertilizer and soil conditioner. This is most beneficial in areas where the source of water hyacinth is close to where the compost is to be used. This would eliminate transport costs. Care should also be taken not to use plants growing in certain polluted waters as they may contain toxic pollutants.

The effluent and sludge from biogas digesters may also be beneficial for improving soils.

Attention should be paid that the parasites and pathogens which may be present in the water hyacinth are destroyed during composting processes, etc.

#### f) Mushroom bedding material

Dried water hyacinth has been successfully used as bedding for cultivating *Volvaria* mushrooms.

#### g) Carbon black production

Encouraging results have been reported on carbonising dried leaf stalks of water hyacinth at 350<sup>0</sup> C to produce carbon black. Carbon black is used in the manufacture of paints, printing inks, carbon paper, tyres and tubes, black paper etc. Further experiments were indicated.

#### h) Activated carbon

Successful experiments have been conducted in Bangladesh on the production of activated carbon from dried stems of water hyacinth which had been carbonised at 350<sup>0</sup>C. Further experimentation is required and economic evaluation of the advantages over existing production methods.

#### i) Handicrafts

Visitors to Thailand have remarked on the attractive handicrafts, e.g. handbags and household

decorations, made from dried water hyacinth leaf stalks, which are offered for sale. These handicrafts could be turned out locally as a cottage industry in rural areas.

#### j) Furniture

Furniture made by using water hyacinth is also now manufactured in Thailand and exported to France. The technical details are said to be a closely guarded secret but experiments carried out locally should eventually yield a product of comparable quality.

### Conclusion

The foregoing account outlines briefly the directions in which work has been carried out overseas on utilization of water hyacinth as a resource. Much money has been spent over the years in trying (unsuccessfully) to eradicate water hyacinth. While agreeing that it poses problems if allowed to spread unchecked, more attention should be paid now to this plant, which grows luxuriantly without the need for soil preparation, added fertilizer, pesticides, weeding etc. It uses, instead, a natural system of hydroponic, without the use of fertilizer and pesticides. Assistance in overcoming any difficulties encountered could be sought from the relevant authorities in the area who would have at their disposal facilities and sources of information, which may not be available to private individuals. It would be a pity if the sole significant use of this plant continued to be made in Sri Lanka was to be the gathering of its beautiful flowers.

### Further reading

- 1) National Academy of Sciences USA, "Making Aquatic Weeds Useful : Some Perspectives for Developing Countries", 174 pp. (1976).
- 2) UNEP Reports and Proceedings Series, No. 7, "Proceedings of the International Conference on Water Hyacinth" (G. Thyagarajan, ed.) 1005 pp. (1984).