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# Chemical Properties of Water Hyancinth Plant Ash

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***Abstract***

*In ponds, water hyacinth expands rapidly and doubles in size in just two weeks. The significance of integrated and adaptable management strategies that take into account the ecological, economic, and social aspects of water hyacinth reduction is emphasized in this abstract. To successfully handle the water hyacinth issue and encourage the sustainable use of this problematic plant, cooperation among governments, communities, researchers, and environmental groups is essential. We can improve the quality of life for individuals impacted by the existence of water hyacinth by putting these measures into practice and working to restore the health of aquatic ecosystems. The dense mats of water hyacinth on the water's surface can block sunlight, reduce oxygen levels, and obstruct natural water movement, which can have a negative impact on native aquatic species and ecological balance. Additionally, its presence in water bodies can hinder fishing, transportation, and irrigation, which can result in losses for people who depend on these resources economically.*

**Keywords:** *Water, Chemical, Ash*

## 1. Introduction

The aquatic plant is known scientifically as Eichhornia crassipes. the water plant that rises at slower or stiller water sources and flows freely. By growing quickly, water hyacinth produces a significant amount of biomass and doubles its population in two weeks. Numerous problems are attributed to water hyacinth. These include the extinction of some aquatic species as well as biodiversity loss, water pollution, water loss, agricultural harm, infrastructural damage, and adverse effects on human health and safety. As a result, an inexpensive organic additive from the plant may be utilized in place of concrete. In this research effort, bio-waste is utilized in place of cement in building.

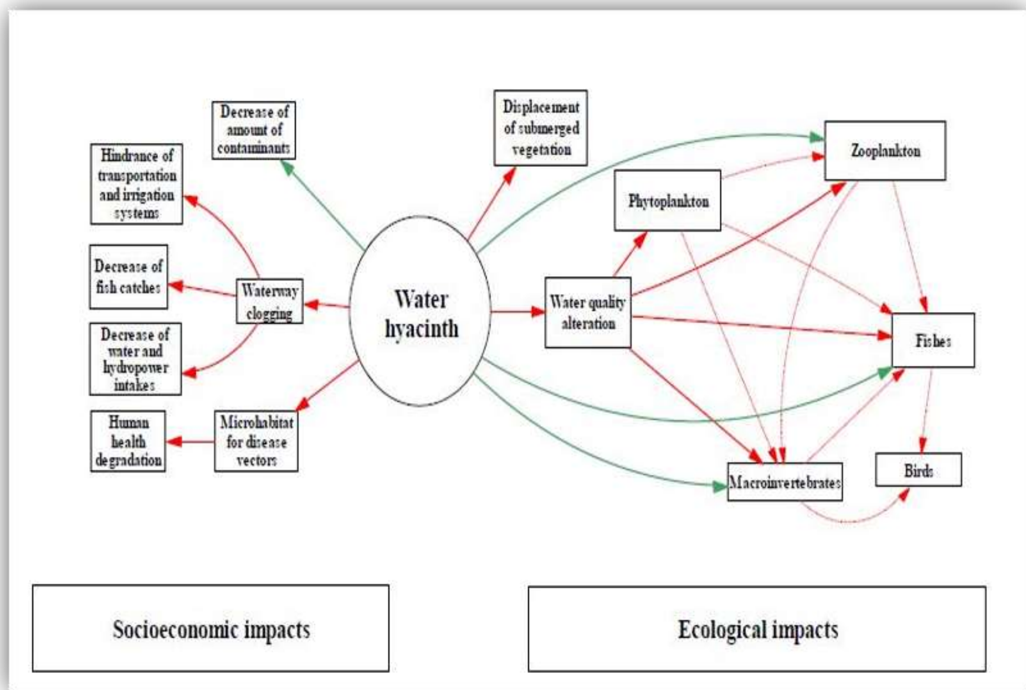
### Characteristics of Water Hyacinth

Water hyacinth often grows in a still lake or pool. The plant may grow up to 1 m tall and has a height range of 100 to 200 mm. Long, comfy roots and shiny green leaves make up this plant. Petioles have resembled an upright, inflated bladder. Flowers are around 50 mm wide and appear to be a light shade of blue or violet. Water hyacinth may be found in both alkaline and acidic waters. The daily evaluation of the plant growth rate is 1.15 percent.

### Water Hyacinth Problem

- River Distribution Barrier,
- Irrigation Intakes Blocked,

- Water Supplies And Electricity Supplies,
- Canals Blocked And Rivers Flooded
- Decrease In Biodiversity
- Oxygen Depletion And Water Quality Declined,
- Effects On Human Health,
- Fishing Issue, And
- Reduced Nutrient Intake In Water




### Mechanisms For Water Hyacinth Control

Rapid development of native flora and water hyacinth. The following techniques are employed to eradicate freshwater weeds:

**Chemical control:** Herbicides that are safe for the environment are utilized.

**Mechanical control**: Weeds can be pulled out by machine or by hand.

**Genetic management** is the employment of organisms to control the growth of aquatic plants.

**Integrated control** combines the three controls mentioned above.

### History of Water Hyacinth

Originating originally in North America, Asia, Australia, Africa, and New Zealand, water hyacinth is now grown worldwide. Only the bigger water areas or stagnant ponds contain it. In the year 1884, the first water hyacinth was discovered in North America. Water hyacinth was an unregulated and serious issue in New Guinea. Eichhornia Crassipes, a species of water hyacinth that is most prevalent, was discovered in an African lake named Victoria in the 1980s. Water hyacinth plants flourish in humid environments in the southern United States, North and South Africa, South Asia, and Australia. Over the past century, the plant has grown over the whole region, causing a number of socioeconomic problems. The water hyacinth is brought from South America and Brazil for decorative usage. Up to 2008, plants were dispersed over the Pacific and Eastern United States during the 1900s. In the region of Oregon state, water hyacinth is not legally recognized as a dangerous weed.

According to Gopal (1987), the water hyacinth was first discovered and counted in great numbers in Egypt between the years of 1889 and 1892. It is located in the Delta area and at first glance seems to be a pretty plant. As a result of the construction of the Aswan Dam, it slowly begins to extend southward.

In the year 1908, the second record was discovered in southern Africa. The plants seem like a beautiful aquatic crop for garden lakes and develop quickly these years. (Stent 1913). Early in the year 1913 (Jacot 1979), the water hyacinth plant is not formally recognized as a hazardous plant.

The 1937 water hyacinth plant mass in Zimbabwe set a third record for the country. The factory becomes environmentally damaging around 1950 near the Mukuvisi River basin in Harare. There are records for 10 African nations between 1941 and 1960. By the end of 1900, Japan and Indonesia are two countries in Asia that are well-known for their water hyacinth plants. (Uekietal,1975). In Asian botanical gardens, the water hyacinth plant is raised for decorative purposes (Backer, 1951).

During the nineteenth century in India, the plant was well-known in the Bengal region. It now covers 2,000 000 hectares of water surface and is present in all sorts of bodies of water across the nation. Tamilnadu receives water from Veeranum Lake.

**Morphology of WHA:**

The morphology of water hyacinth plants defines their forms, structures, colors, patterns, and sizes. Water hyacinth plants typically resemble large, glossy leaves. The plant develops 1 meter higher toward the vertical in the water. The stem's 10–20 cm-long leaves grow across it and float on nodules. Large, springy, and rounded are stalks. Flowers have more appealing colors than the roots, which are purple-black in appearance. It has six petals, and the blossoms are pink or lavender in hue.

According to Center et al. (2005), water hyacinths have stolons that allow them to float freely, and each rosette is oriented vertically. On each stem, there are six to eight petals. Due of its spongy, bubble leaves with air holes, petals float on a water surface. Round water hyacinths have shiny green foliage and mauve blossoms that resemble orchids. Lavender-colored flowers stand vertically over the top of the plant at an elevation. Petals can range in height from 0 to 1.5 meters depending on their shape.

According to Babuet.al, 2003, water hyacinth is an enormously prolific aquatic plant. Ten plants may yield 655,330 individuals at eight months. Therefore, one plant can create 8191 different plants. The water hyacinth plant is one of the top 10 fastest-growing weeds and may grow quite quickly. Normal production from 10 plants is 600000 in eight months, and they totally fill 0.4 hectares of freshwater pools. A fresh rosette forms and becomes joined to the mother plant. Stolon separates out and may be broken down quickly. In the ponds, the new plant establishes new colonies.

**Chemistry of Water Hyacinth**

(1) The Water hyacinth plant is 95.5% moist, contains 3.5% organic matter, 0.04 percent nitrogen, 0.06 percent phosphorus, and 1.0 percent ash; (2) Water hyacinth is entirely dehydrated, moisture-free, and has an organic matter content of 75%, nitrogen content of 1.5%, and an ash content of 24.2%; (3) Ash formed from water hyacinth comprises K2O at a concentration of 28.7%, Na2O at 1.8%, CaO at 12.8%, Cl at 21.0%, and P2O5 at 7.0%. when the plant is fully dried; (4) Lead, Hg, and Sr 90 were all absorbed by the roots of water hyacinth plants. The lowering of characteristics from 38% to 96% raises the water quality from class IV to classes III and II; (5) The density of water hyacinths ranged from low (10 kg/m2) to high (50 kg/m2).

**Life Cycle and Reproductive Strategies**

The life cycle of a water hyacinth plant is comparable to that of other plants. seeds that were thrown into the water body or crop traps throughout the spring. Depending on the environment, it will either grow or perish. Winter is an ideal time for water hyacinth plant growth. Water hyacinth, according to Penpound and Earle (1948), recovers and keeps on growing till spring. In the spring, Eichhornia crassipes seeds germinate. It is a blooming plant, and the springtime is when it grows quickly.

According to Penpound et al. (1948), water hyacinth generates 500 ovules, however only 50 of those ovules are fertilized each capsule. The plant releases its seeds, which fall into nearby bodies of water. Colonies of Eichhornia crassipies can spread quite quickly. With the help of its system for regeneration and development, it can heal the injured colonies.

According to Centeret., al. (2005), hyacinth plants can reproduce in two ways: one generation and one vegetative. The nurturing plant receives new seedlings that are linked to it. Since they are so light, the stolons separate from the mother plants with ease. In aquatic bodies, the young plants float and establish colonies. The buds have two options: they can produce stolen fruit or they may cease growing and reach maturity sooner. Growth of the water hyacinth plant is dependent on photosynthesis. By allowing carbon dioxide to dissolve via the roots, it can promote photosynthesis.

**Dispersal and Movement**

Due to additional daughter plants, the water hyacinth plant is producing in excess. The water plants separate and relocate during floods and periods of high water flow. The main expansion of plants was brought on by human actions like decorative plant planting near dams and ponds. Additionally, it can spread via boat machinery and equipment. The main plant food source is seeds, which can be made by people, birds, and winds.

**Biological Dispersal**

Plants travel in the direction of the wind, and their leaves may sail over canals and lakes. Plants can travel from one region to another due to strong water flow.

Water hyacinth seeds are conveyed over a great distance by birds as a vector of transmission.

**Accidental**

Canoes, boats, and bags can all be used to mistakenly carry plants. As a result, seeds from plants can spread over places with water.

**Usefulness of Water Hyacinth**

The plants and leftovers of water hyacinth are used to extract a number of valuable goods. The water hyacinth plant has several uses, including those for biogas, biohydrogen, biopolymer, biofertilizers, fish feed, fuel briquettes, and absorbents. One cultivation method is to use water hyacinth.

According to Ding Jianging (2001), plants may be fed to animals. For the purpose of feeding pigs and buffalo, several animals are employed. In China between 1950 and 1970, they were crucial food plants for animals. The plants are extracted from lakes or swimming pools after being thoroughly cleansed of dirt and debris. Then it dries outside for two or three days. Dried leaf material is milled and then bagged in polyethylene after being ground. Animals are fed water hyacinth in addition to their regular diet.

**Water Hyacinth As Biofertilizer**

Water hyacinth may be utilized as manure or fertilizer for the soil when used in irrigation. Manure is incorporated into the soil to strengthen it. Proteins, sugar, carbohydrates, lipids, and fats are present in the plant compost. These composts were combined and developed in heaps in the warm, tropical atmosphere. Water hyacinth is combined with soil and municipal garbage in Sri Lanka and used as fertilizer.

Water hyacinth management is discussed by Nath and Singh (2016), who also note that the plant has access to pH, phosphate, calcium, and organic carbon. The plants are harvested every 15 to 60 days. It is exposed to sunshine to dry, which reduces the plant's weight to between 1 and 2 kg.

**Chemical Composition of WHA**

According to Neelu Das and Shashikant Singh (2016), the Rigaku diffractometer is capable of performing the XRD test for the water hyacinth's mineralogical composition. According to the table below, compared to cement (2.6%), water hyacinth ash has a larger loss of ignition (31.6%). It suggests that the carbon is free. The amount of Cao is somewhat higher than other compositions, although the overall elemental compound content of silica, iron, and alumina does not surpass 13%. The presence of calcium, which might be used as an alternate material for concrete, is demonstrated by Cao (22.61%). The water hyacinth stem ash contains calcite and potassium in significant amounts, according to the findings of X-ray diffraction. The peaks of potassium oxide are at 23.1800, 28.4800, and 40.6400. At the peaks of 23.1800, 29.5400, 36.0800, 47.6200, 48.6000, 57.5000, and 95.0600, calcite is present. In stem ash, the trace element quartz is present. It demonstrates that water hyacinth ash may be used as a cement additive.

According to a 2015 article by AhmedShabanAbdel Hay et al., water hyacinth is harvested from the Beni-suef canal. Ash from the 950 degree burn of the plants was collected. The chemical makeup of the ash, which is used to replace the amount of cement, is shown below.

**Table 1:** Chemical Composition of Wha

| SiO2 | Al2O3 | Fe2O3 | CaO | MgO | SO3 | TiO2 | P2O5 | Na2O | K2O |
|---|---|---|---|---|---|---|---|---|---|
| 23.30 | 4.23 | 25.98 | 17.4 | 4.45 | 5.06 | 0.61 | 3.85 | 1.49 | 7.43 |

**XRD**

From the fractured specimen, samples are taken and put through an XRD examination. It is employed to determine the composition of samples of rock or mineral. To gather the characteristics in the sample specimen, an X-ray laser and diffracted rays from the crystalline phases are applied to the powder sample. To accomplish the chemical analysis, the phases are recognized and their chemical composition is connected. The specimen, which is smaller than 63mm, is well-grounded. Model X'per PRO XRD Test with 2.2 kW maximum radiation was conducted. The equipment uses graphite crystal diffraction beams with sample spinners. The chemical properties (amorphous or crystal) were examined by beam diffraction.


**Figure 1:** Xrd Apparatus

**SEM-EDAX**

Using a scanning electron microscope, the size, forms, surface roughness, and fracture are identified. Concrete samples are cut out and examined under a scanning microscope. The specimen components are categorized using the EDAX approach. When a sample is positioned on the beam, several signals help to identify how the samples interact. The specimen is divided into 10mm square cubes, with one side being ground flat. The hydration processes are stopped with acetone. The item is then dried and prepared for conducting. Finally, a SEM micrograph was captured.

**Energy-Dispersive X-ray Spectroscopy, or EDAX**, is a technique used for specimen and fundamental analysis. The source in the sample for chemical characterisation is X-rays. Many electrons are removed from the atoms as a result of the electron beam passing through the sample. The high state of electrons fills the empty space in the electrons, and two electrons balance the X-ray energy. When the energy hits the detector, a pulse of charge is produced. The load pulse is changed into the output pulse using load-sensitive preamplifiers. The computer receives the energy from the voltage measurement after that. On the computer, the atomic weight and weight in grams of the element's compounds are shown.

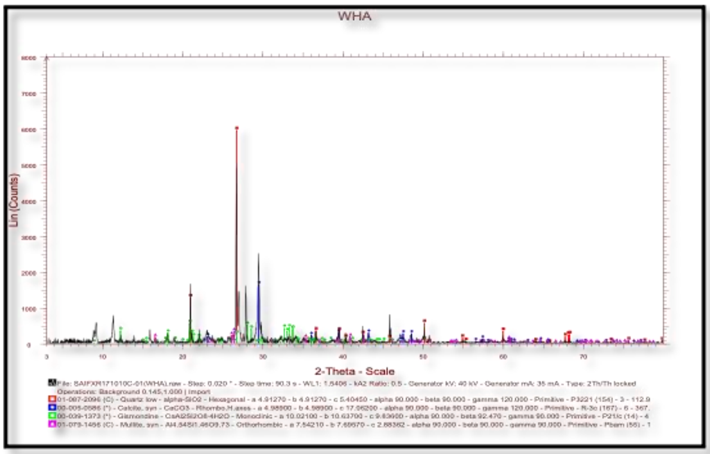
**Correlation Properties of WHA with Cement**

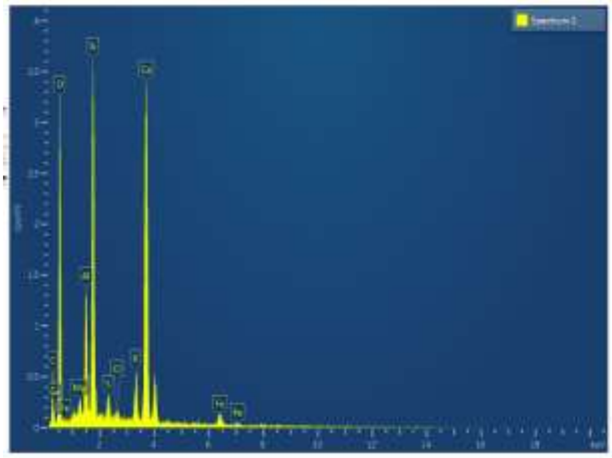
Ash from water hyacinths has properties that are similar to those of concrete. The two main ingredients of cement, together with water hyacinth ash, are calcite and quartz. Albite, Gismondine, and hydrated cement are combined to create zeolite. Both cement and water hyacinth ash contain it.

Mullite, an aluminosilicate mineral, is abundant in water hyacinth ash. The samples have solidified, as seen by the Strong and Sharp peak. The prominent peak, which is seen in quartz from table 2 and albite from table 2, has a greater intensity of 100. Due to interference between diffractions created in the lattice, cement has 18 peak planes and water hyacinth ash has 13.

Table 2: Peak Intensity of WHA

| 2 Theta | D-spacing | Relative Intensity % | Phase | Lattice Axis |
|---|---|---|---|---|
| 26.644 | 3.3429 | 100 | $SiO_2$- Quartz | 4.9127, 4.9127,5.404 |
| 29.402 | 3.0354 | 62 | CaCO3-Calcite | 4.989,4.989,17.06 |
| 27.822 | 3.2040 | 32 | Al454Si1.46O9.73-Mullite | 10.021,10.637,9.836 |
| 36.037 | 2.4902 | 6.3 | $CaAl_2Si_2O_8.4H_20$ Gismondine | 7.542,7.695,2.883 |



**EDAX**

**Figure 2:** EDAX

According to the WHA's EDAX study, the main element, calcium, is present along with other minerals including silica, aluminum, and iron. Cao has been the main component in both situations, and it passes through pozzolanic processes. It is concluded that WHA hardens and gains strength because it includes more than 20% Cao. When the Cao concentration exceeds 20%, the fly ash's grade C lime content is met. Since calcium is found in WHA, some of the cement on the concrete is replaced.

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## 2. Conclusion

Conclusion; (1) According to XRD analyses, water hyacinth ash and cement both include comparable components as calcite, quartz, and zeolite; (2) According to SEM data, cement and water hyacinth ash exhibit a variety of morphologies and their forms. Visual observation of the hydration reaction in cement and WHA led to the conclusion that WHA, at a specific proportion, had superior pozzolanic materials than cement; (3) Cao above 20%, according to EDAX study, gives it strength and hardens. When the Cao is greater than 20%, the fly ash grade C's requisite lime content is met..

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