

AQUAPONICS

INTEGRATION OF HYDRPONICS WITH AQUACULTURE

Submitted in partial fulfillment of the requirements for the award of
bachelor of engineering / technology degree in biotechnology (specialization of degree)

by

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DECLARATION

EDWIN VENIS RAJ (39230015), BAGHAVATHY DHARSHAN (39230005) hereby declare that the project entitled AQUAPONICS-integration of hydroponics with aquaculture done by me under guidance of Dr.USHA NANDHINI S (INTERNAL) AND Dr.PRABHU (EXTERNAL) at sathyabama intitute of science & technology is submitted in partial Fulfillment of the requirements for the award of bachelor of engineering / technology degree in biotechnology

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ABSTRACT

HYDROPONICS IS A MODERN-DAY AGRICULTURE ALSO KNOWN AS URBAN AGRICULTURE. IT DOES NOT REQUIRE SOIL. IT IS A GOOD ALTERNATIVE FOR PRODUCING HEALTHY CROPS AND VEGETABLES, FREE FROM SOIL BORNE PATHOGENS AS IT NOT GROWN ON SOIL .

AQUAPONICS IS A CLOSED LOOP, RECIRCULATING FRESH WATER SYSTEM IN WHICH PLANTS AND FISH GROW TOGETHER SYMBIOTICALLY.

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INTRODUCTION

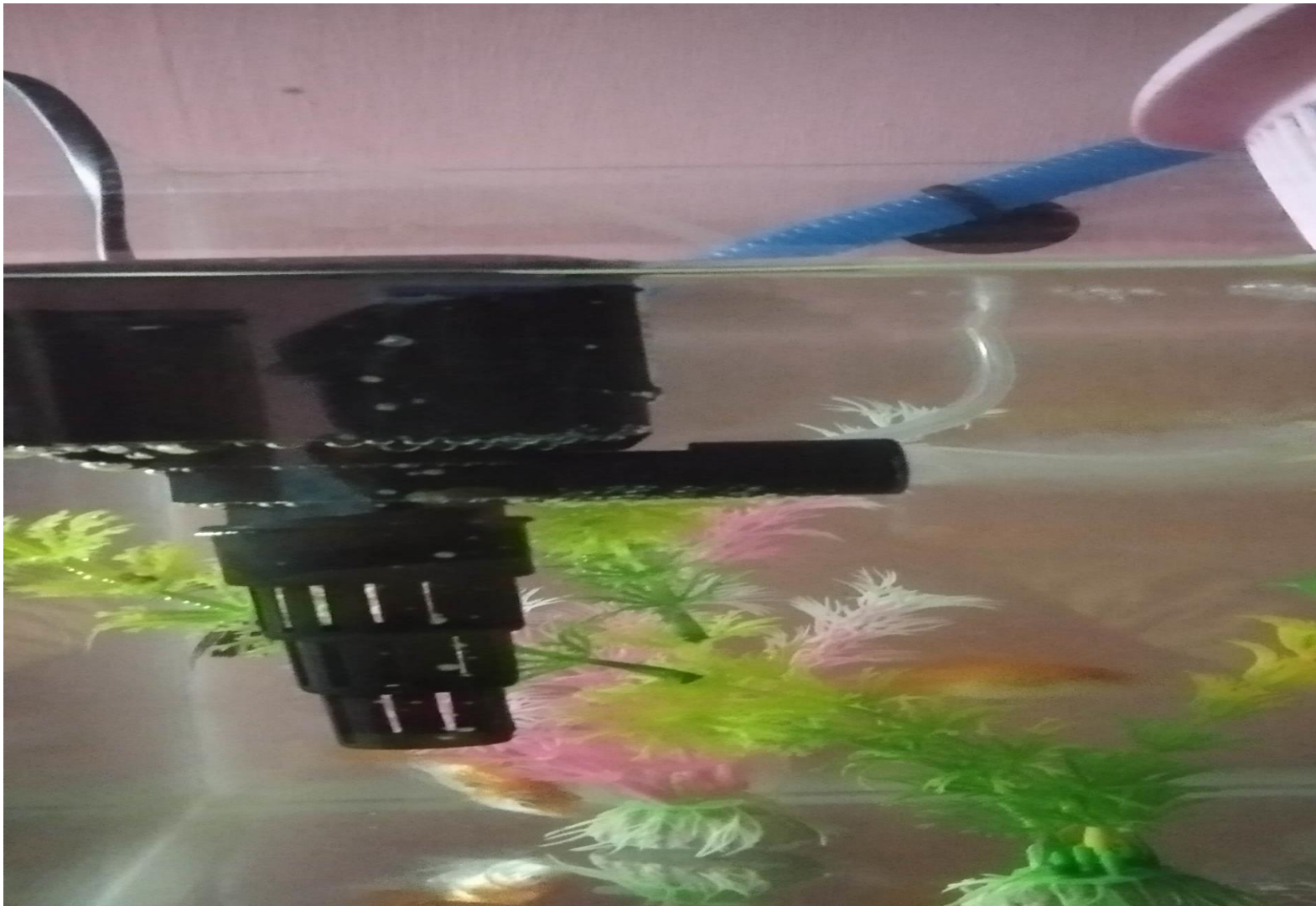
Aquaponics, also known as the integration of hydroponics with aquaculture, is gaining increased attention as a bio-integrated food production system. Aquaponics serves as a model of sustainable food production by following certain principles: The waste products of one biological system serve as nutrients for a second biological system. The integration of fish and plants results in a polyculture that increases diversity and yields multiple products. Water is re-used through biological filtration and recirculation. Local food production provides access to healthy foods and enhances the local economy. In aquaponics, nutrient-rich effluent from fish tanks is used to fertigate hydroponic production beds. This is good for the fish because plant roots and rhizobacteria remove nutrients from the water. These nutrients – generated from fish manure, algae, and decomposing fish feed – are contaminants that would otherwise build up to toxic levels in the fish tanks, but instead serve as liquid fertilizer to hydroponically grown plants. In turn, the hydroponic beds function as a biofilter – stripping off ammonia, nitrates, nitrites, and phosphorus – so the freshly cleansed water can then be recirculated back into the fish tanks. The nitrifying bacteria living in the gravel and in association with the plant roots play a critical role in nutrient cycling; without these microorganisms the whole system would stop functioning. Greenhouse growers and farmers are taking note of aquaponics for several reasons: Hydroponic growers view fish manured irrigation water as a source of organic fertilizer that enables plants to grow well. Fish farmers view hydroponics as a biofiltration method to facilitate intensive recirculating aquaculture. Greenhouse growers view aquaponics as a way to introduce organic hydroponic produce into the marketplace, since the only fertility input is fish feed and all of the nutrients pass through a biological process.

MATERIALS REQUIRED

FISH TANK,
FISH TANK WASTE (FISH WASTE),
PUMP,
MOTOR,
PIPE,
FRESH WATER,
NET BUCKET,
BIOMEDIA FILTER,
SEEDS AND PLANTS



FISHES AND FISH TANK



MOTOR AND PUMP



PIPE

(CONNECTED WITH PUMP)



NET BUCKET



BIO MEDIA FILTER AND PLANTS

BIOMEDIA FILTER

Biofiltration and Suspended Solids: Aquaculture effluent contains nutrients, dissolved solids, and waste by products. Some aquaponic systems are designed with intermediate filters and cartridges to collect suspended solids in fish effluent, and to facilitate conversion of ammonia and other waste products to forms more available to plants prior to delivery to hydroponic vegetable beds. Other systems deliver fish effluent directly to gravel-cultured hydroponic vegetable beds. The gravel functions as a “fluidized bed bioreactor,” removing dissolved solids and providing habitat for nitrifying bacteria involved in nutrient conversions. The design manuals and technical documentation available in the Resources section can help growers decide which system is most appropriate.

Aquaponics: Key Elements and Considerations

A successful aquaponics enterprise requires special training, skills, and management. The following items point to key elements and considerations to help prospective growers evaluate the integration of hydroponics with aquaculture.

Hydroponics: Hydroponics is the production of plants in a soilless medium whereby all of the nutrients supplied to the crop are dissolved in water. Liquid hydroponic systems employ the nutrient film technique (NFT), floating rafts, and noncirculating water culture. Aggregate hydroponic systems employ inert, organic, and mixed media contained in bag, trough, trench, pipe, or bench setups. Aggregate media used in these systems include perlite, vermiculite, gravel, sand, expanded clay, peat, and sawdust. Normally, hydroponic plants are fertigated (soluble fertilizers injected into irrigation water) on a periodical cycle to maintain moist roots and provide a constant supply of nutrients. These hydroponic nutrients are usually derived from synthetic commercial fertilizers, such as calcium nitrate, that are highly soluble in water. However, hydro organics – based on soluble organic fertilizers such as fish hydro sylate – is an emerging practice. Hydroponic recipes are based on chemical formulations that deliver precise concentrations of mineral elements. The controlled delivery of nutrients, water, and environmental modifications under greenhouse conditions is a major reason why hydroponics is so successful. and are well adapted to aquaponic system.

Fish Species: Several warm-water and cold water fish species are adapted to recirculating aquaculture systems, including tilapia, trout, perch, Arctic char, and bass. However, most commercial aquaponic systems in North America are based on tilapia. Tilapia is a warm-water species that grows well in a recirculating tank culture. Furthermore, tilapia is tolerant of fluctuating water conditions such as pH, temperature, oxygen, and dissolved solids. Tilapia produces a white fleshed meat suitable to local and wholesale markets. The literature on tilapia contains extensive technical documentation and cultural procedures. Barramundi and Murray cod fish species are raised in recirculating aquaponic systems in Australia.

Water Quality Characteristics: Fish raised in recirculating tank culture require good water quality conditions. Water quality testing kits from aquacultural supply companies are fundamental. Critical water quality parameters include dissolved oxygen, carbon dioxide, ammonia, nitrate, nitrite, pH, chlorine, and other characteristics. The stocking density of fish, growth rate of fish, feeding rate and volume, and related environmental fluctuations can elicit rapid changes in water quality; constant and vigilant water quality monitoring is essential.

APPLICATION

The integration of fish and plants in a closed-loop, symbiotic system is commonly referred to as aquaponics. The sustainable design of combined food production has led to many advances and new directions during the past decade. Aquaponics presents a promising new direction for enhancing bioregenerative life support systems for space because of its recycling design and high productivity of plants and fish. Researchers around the globe are now engaged in enhancing aquaponics system sustainability, while reducing inputs (water, fish feed, energy for moving water and supplying oxygen) at the same time increasing outputs in the form of edible food. New methodologies have created advances in these integrated systems, closing the loop of sustainability even tighter. Water use efficiency and nutrient cycling are the major advantages of aquaponic food production over other methods currently used. Decoupled, or dual-loop systems, have been developed that separate the two compartments (fish and plants) for optimization of each component. Nutrient solutions derived from mineralized fish effluents can easily be tailored for specific plants with the addition of small amounts of nutrient salts. This move toward isolating each unit also provides risk-mitigation in the event one of the systems fails. New aquaponics diets are being developed that are designed not just for fish but for the fish and plants by over-fortifying fish diets with additional plant nutrients.

Other new directions in fish feed formulation includes replacing fish meal and oil with other sources of protein from plants, insects or algae. Fish feeds formulated with algae have the potential to enhance the nutritional quality of the fish protein by increasing the heart-healthy omega oil content of the final product. Many fish species have now been successfully cultivated in aquaponics systems, spanning a diverse range of temperature. Warm-water fish like tilapia (*Oreochromis spp.*) and cold water fish such as trout, sturgeon and salmon are successfully being integrated with plants in a beneficial union. The fish provide the majority of the nutrients while the plants clean the water allowing for recycling while creating a zero-discharge facility. Proper air handling allows cycling of the CO₂ rich environment created from fish respiration through the plant component, increasing the photosynthetic rate and yield of plant crops, with the added benefit of oxygen being released by the plants. This paper covers the most recent advances in aquaponics in terms of food, energy and water production and use, all critical parameters to optimize for successful adoption as bioregenerative space life support systems.

ABSERVATION

Aquaponics is a bio-integrated system that links recirculating aquaculture with hydroponic vegetable, flower, and/or herb production. Recent advances by researchers and growers alike have turned aquaponics into a working model of sustainable food production. This publication provides an introduction to aquaponics with brief profiles of working units around the country. An extensive list of resources points the reader to print and Web-based educational materials for further technical assistance.

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6. S&S Aqua Farm – Design Manual [www.jaggartech. Com/](http://www.jaggartech.Com/)

RESULT

Finally by using aquaculture method, the waste of fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, Which in turn purify the water.

