Algae Nutrition vanguard

Algae Powered Nutrition
Transforming Urban food System

By highlighting leadership in innovation food production it reflects the patents food production focus through urban scalability and nutritional advancement

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Chapter 1: Introduction

Algae-based nutrition refers to the use of algae simple, aquatic organisms rich in proteins, essential fats, vitamins, and minerals as a source of food or as a supplement in human and animal diets. Unlike traditional crops, algae can grow in water without soil and require significantly less land, energy, and freshwater. This makes them a strong candidate for sustainable food solutions, especially in urban settings where space is limited and environmental pressures are growing.

As cities grow rapidly, their food systems are under stress. Urban populations continue to rise, and with them come higher demands for food, water, and energy. Cities often rely on rural and international supply chains, which are increasingly vulnerable to disruption from climate change, economic shocks, and political instability. The result is rising food insecurity, malnutrition, and dependence on unsustainable food systems.

Urban food system transformation is no longer optional. To build resilient, future-ready cities, we need food production methods that can operate within the city limits methods that are efficient, climate-smart, and adaptable to available infrastructure. Algae-based systems fit this need. They can be grown on rooftops, in vertical units, or integrated into aquaponic farms. They can thrive in controlled indoor environments and convert waste streams, such as greywater or carbon emissions, into biomass. Their high productivity per square meter offers an edge over many land-based crops.

Algae's contribution to food sustainability goes beyond yield. Their cultivation absorbs carbon dioxide and helps purify water. Their nutritional value makes them suitable for tackling malnutrition. They can be used directly in food products or indirectly as animal feed, biofertilizers, and food additives. Some species are especially rich in omega-3 fatty acids and antioxidants, contributing to human health while reducing pressure on marine resources traditionally used to extract similar nutrients.

Algae also contribute to circular economy principles. Waste from one process can become an input for algae cultivation. Urban organic waste and CO_2 emissions from nearby buildings or industries can be directed to algae bioreactors. In turn, the harvested algae biomass can support food, fuel, and fertilizer needs within the city. This cycle reduces dependency on external inputs and builds local resilience.

In this context, the PBRC_11.1_C algae system offers a timely innovation. Built as an upgrade from the PBRC_9.1_C model, this next-generation platform integrates modular bioreactors with smart sensors and automation. It supports decentralized, small-to-medium scale algae production in urban environments bringing sustainability down to the neighborhood level. From schools and hospitals to urban farms and food distribution centers, PBRC_11.1_C adapts to different spaces and end uses.

In the chapters that follow, we explore how this new model works, what makes it unique, and how it can be integrated into urban food systems. We look at the broader ecosystem impacts from climate resilience to social inclusion and detail the pathways for scaling algae-based solutions across other cities and regions.

As climate risks mount and cities become denser, algae systems provide a clean, efficient, and low-resource option for meeting nutritional needs and closing resource loops. With support from local governments, development agencies, and communities, algae-based nutrition can play a vital role in shaping a more sustainable urban future.

Chapter2: Background and Context

Cities around the world are facing growing challenges when it comes to feeding their populations. As more people move into urban areas, food systems are struggling to keep up. Urban food insecurity is no longer a problem of the future it's already here. In many low- and middle-income cities, poor households often have limited access to fresh, nutritious food. Even in wealthier countries, the cost of healthy food is rising, and urban diets are becoming more dependent on processed and low-nutrient options.

Urban food insecurity is shaped by several factors. One is the long and fragile food supply chain. Most cities import a large portion of their food from distant rural areas or even from abroad. When supply chains are disrupted by extreme weather, fuel costs, political instability, or economic downturns, cities face shortages and price hikes. Another factor is inequality. Low-income neighborhoods often lack supermarkets or fresh produce markets. This creates "food deserts" where people must rely on fast food or processed items from convenience stores.

Climate change is also making things worse. Rising temperatures, unpredictable rainfall, and natural disasters reduce food production in rural areas. For cities that rely heavily on these rural sources, any drop in supply can quickly lead to higher prices and food stress. Urban areas are especially vulnerable because they don’t produce much food themselves. And with limited space, growing food inside the city is not easy without new approaches.

These problems are not just about quantity they are also about quality. Malnutrition in cities is growing. On one end, there’s undernutrition, where people don’t get enough vitamins, minerals, or calories. On the other, there’s obesity, caused by diets rich in sugar, salt, and fat but low in real nutrients. Children in urban slums often face stunted growth due to poor diets. Meanwhile, many adults suffer from lifestyle diseases like diabetes, heart problems, and high blood pressure, all linked to unhealthy food.

Nutrition gaps in cities stem from limited access to affordable, nutritious food. Vegetables, fruits, lean proteins, and whole grains are often too expensive or unavailable in the areas where low-income families live. Without targeted interventions, these gaps will only widen. There is a strong need for food sources that are cheap to produce, easy to grow locally, and rich in the nutrients people need.

This is where algae comes in. Algae have been part of the human diet for centuries in many parts of the world. In East Asia, people have eaten seaweed for thousands of years. Countries like Japan, Korea, and China use algae in soups, salads, and snacks. In Africa and Latin America, certain freshwater algae like spirulina have also been harvested and consumed for generations. For example, communities near Lake Chad have traditionally dried and eaten spirulina as a protein source.

Algae were often valued for their high nutritional content. They are packed with protein, iron, and essential fatty acids. Some types contain antioxidants, vitamins A, C, and E, and other health-boosting compounds. Unlike most plants, algae grow fast and can be cultivated in water tanks, ponds, or bioreactors. They don't need fertile land or heavy irrigation. This makes them ideal for dense urban settings, especially in areas where space and resources are limited.

Modern science is now catching up with what traditional communities have known for a long time. Algae are not just a niche food or a health trend they are a serious solution to nutrition problems. In recent years, food scientists, urban planners, and policy experts have started exploring how algae could be used in city-based food systems. Spirulina and chlorella powders are already available in stores, and companies are experimenting with algae-based snacks, protein bars, meat alternatives, and even pasta.

But despite this progress, algae are still underused in the fight against urban food insecurity. Many people are unaware of their benefits. There are also cultural barriers algae may seem unfamiliar or unappealing to some consumers. Yet these challenges can be overcome with proper education, recipe innovation, and policy support.

The idea is not to replace all other food sources with algae. Instead, algae can serve as a supplement or fallback option when other food sources are unavailable or too expensive. They can also help fill critical nutrition gaps in diets that lack essential nutrients. For example, a small daily amount of spirulina can provide enough iron and protein to make a difference in a child's development or an adult's energy levels.

In urban areas where food production is difficult, algae systems offer a rare chance to grow high-value nutrition locally. They can be set up on rooftops, inside buildings, or near wastewater treatment plants. They can use recycled water, absorb carbon from the air, and provide a steady output with minimal inputs. This makes them suitable for emergency food response, school feeding programs, hospital nutrition, and more.

The historical use of algae in food shows us that this is not an untested idea. Cultures have relied on algae in different forms for centuries. What's new is the effort to scale up production, make it affordable, and bring it into the daily lives of urban residents. With the right tools and awareness, algae can help cities close the nutrition gap and build stronger, fairer food systems. The PBRC_11.1_C system builds on this vision by making algae cultivation possible even in small, urban spaces.

Chapter 3: Scientific Basis of Algae Nutrition

Algae are microscopic or macroscopic plant-like organisms that thrive in water environments, both fresh and marine. While commonly associated with ocean ecosystems, certain algae species have been consumed by humans for centuries because of their rich nutritional content. In the context of urban food systems and nutritional challenges, algae offer a sustainable and powerful option due to their dense nutrient profile, low resource demand, and potential for local production.

Nutritional Composition

Algae are packed with essential nutrients, making them highly beneficial for human health. Their nutritional composition varies depending on the species, but most edible algae are known for being protein-rich, vitamin-dense, and full of important fatty acids.

One of the major selling points of edible algae is its protein content. Spirulina, for example, contains about 60 to 70 percent protein by dry weight, which is more than beef, chicken, or soy. This protein includes all nine essential amino acids, making it a complete protein source suitable for vegetarians and vegans.

In addition to protein, algae contain a broad range of vitamins, including B-complex vitamins (especially B1, B2, B3, B6, and B12), vitamin C, and vitamin E. Some species also have significant amounts of vitamin A in the form of beta-carotene, which is beneficial for vision, skin health, and immune function.

Algae are also a rare plant-based source of omega-3 fatty acids, especially EPA and DHA. These fatty acids are important for brain function, cardiovascular health, and reducing inflammation. While omega-3s are often sourced from fish, fish themselves acquire it from algae.

This makes algae a direct and sustainable source of these essential fats, especially important for people who avoid seafood.

Minerals are another area where algae shine. Many species provide high levels of iron, magnesium, calcium, potassium, and iodine. This mineral diversity supports a range of body functions, from red blood cell production to bone health and thyroid regulation.

In summary, algae offer a compact, nutrient-dense food source that can fill dietary gaps often seen in urban populations. Their high content of protein, vitamins, and minerals makes them a logical candidate for addressing urban malnutrition.

Health Benefits and Comparisons with Conventional Nutrition

The health benefits of algae are broad and well-documented. Spirulina and Chlorella, two of the most researched species, have shown potential in reducing cholesterol, managing blood sugar levels, enhancing immune response, and even detoxifying heavy metals from the body.

Spirulina has strong antioxidant and anti-inflammatory properties due to its high phycocyanin content, a pigment-protein complex that helps protect cells from damage. Studies have shown that people who consume spirulina regularly experience improved blood lipid profiles, including lower LDL (bad) cholesterol and higher HDL (good) cholesterol levels.

Chlorella is known for its detoxifying abilities. It can bind to heavy metals and unwanted chemicals in the body, assisting in their removal. It also boosts the immune system by increasing the activity of natural killer cells and promoting healthy gut bacteria.

When compared to traditional nutrition sources like meat, dairy, and grains, algae stand out in several ways. First, they deliver a high amount of nutrients in a small volume, making them efficient for people with limited access to diverse food. Second, they are easier to digest than animal proteins and do not come with saturated fat or cholesterol. Third, they can be grown in controlled environments without antibiotics, hormones, or pesticides.

Algae can also be an ideal supplement for vulnerable populations, including children, the elderly, and people recovering from illness. Their high iron content helps combat anemia, while the presence of B12 (especially in spirulina) supports nerve health and cognitive function. However, it's important to note that while spirulina contains B12-like compounds, they are not always bioavailable in the same way as B12 from animal sources. Therefore, algae should complement, not completely replace, a diverse diet.

Key Algae Species in Human Nutrition

Three main types of algae dominate the human nutrition market: Spirulina, Chlorella, and to a lesser extent, Dunaliella and Haematococcus.

Spirulina is a blue-green algae that grows naturally in alkaline lakes. It is considered one of the most nutrient-rich foods in the world. In addition to its high protein content, it offers beta-carotene, iron, and gamma-linolenic acid, a rare fatty acid with anti-inflammatory properties.

Chlorella is a green algae known for its ability to bind to toxins. It also contains high amounts of chlorophyll, which helps in liver detoxification and promoting healthy blood. Chlorella is also rich in nucleic acids (RNA and DNA), supporting cellular repair and regeneration.

Dunaliella salina is known for its high beta-carotene content, which is sometimes extracted for use in food coloring and supplements. It is grown mostly in salt ponds and harvested for its antioxidant properties.

Haematococcus pluvialis is cultivated primarily for its high astaxanthin content, a powerful antioxidant that is being studied for its benefits in eye health, skin protection, and recovery from physical exertion.

Each species has its unique strengths and can be tailored for specific health goals, ranging from immune boosting to detoxification, antioxidant protection, and nutrient supplementation.

Research and Lab Findings

Over the past decade, scientific interest in algae has expanded rapidly. Numerous studies have explored the benefits of algae in both laboratory and real-world settings. Clinical trials involving spirulina have demonstrated positive effects on cholesterol levels, blood sugar control, and immune response. For example, a 2016 meta-analysis of several studies found that spirulina supplementation significantly reduced total cholesterol and triglyceride levels in adults with metabolic disorders.

Animal studies have also supported the idea that algae improve gut health and reduce inflammation. Researchers are now looking into algae’s potential to prevent or manage lifestyle diseases such as type 2 diabetes, hypertension, and cardiovascular conditions.

Lab-based bioavailability studies show that nutrients from algae are generally well-absorbed, especially when dried and powdered correctly. Innovations in algae processing such as freeze-drying and nanoencapsulation are helping retain nutrient integrity and improve shelf life.

Algae's nutritional potential is also being explored in future food systems. In space research, NASA has studied spirulina as a food source for astronauts on long-duration missions because of its high nutrient density and ease of cultivation in closed environments.

In urban research labs, algae are being grown using photobioreactors and closed-loop aquaponic systems to explore how they can be integrated into rooftops and vertical gardens. These systems not only produce algae for food but also contribute to air purification and water recycling, making them ideal for circular food economies.

Conclusion

The scientific basis of algae nutrition is strong and growing stronger. With their high protein content, rich vitamin and mineral profile, and additional benefits like omega-3s and antioxidants, algae offer a legitimate solution to urban malnutrition and food insecurity. They outperform many conventional foods in nutrient density and environmental efficiency, while also supporting health goals across different age groups and health conditions.

By focusing on key species like Spirulina and Chlorella and applying advances from research labs to real-world urban systems, algae can help bridge the nutritional divide in modern cities. Their role in future food systems is not just supplemental but foundational. With more public awareness, supportive policies, and investment in scalable production methods, algae can become a core element of sustainable urban diets.

Chapter 4: Technology and Production

Algae cultivation has shifted from traditional open ponds to more efficient, contained systems. These new technologies make it easier to produce algae in urban areas, using fewer resources while maintaining high yields.

One of the most common cultivation methods today is the photobioreactor. This is a closed system made of transparent tubes or flat panels where algae grow in water mixed with nutrients and exposed to light. The controlled environment helps prevent contamination and allows better monitoring of growth conditions. Photobioreactors can be installed vertically, saving ground space and fitting well into city settings like rooftops or the sides of buildings.

Vertical farms are another approach. Algae tanks are stacked in layers, using artificial or natural light to boost growth. These systems are space-saving and ideal for places with limited land. Vertical farming for algae is often combined with hydroponic or aquaponic systems to make better use of water and nutrients.

A major advantage of algae production is the minimal resource requirement. Algae need only sunlight, carbon dioxide, water, and a small amount of nutrients. They grow much faster than land crops and can be harvested regularly. This means less land and water are used for the same amount of nutritional output, which is especially helpful in cities facing space shortages and water stress.

Urban-friendly systems like modular units allow for plug-and-play installation. These compact units can be placed in schools, community centers, or homes. They are often automated, using sensors to adjust light, temperature, and nutrient levels. Automation reduces the need for daily maintenance, making these systems more accessible for non-experts.

Rooftop tanks are another practical method. These tanks can use rainwater and solar power to keep algae growing with minimal external input. In areas where buildings have flat roofs, this setup turns unused space into productive zones for food or feed production.

These innovations in cultivation make algae a practical part of urban agriculture. They not only save space and resources but also bring food production closer to the point of consumption. This reduces transport emissions and builds resilience into city food systems.

By combining photobioreactors, vertical farming, and modular designs, cities can integrate algae production into daily life. Whether used as a direct food source, animal feed, or fertilizer, algae can thrive in these systems and help transform how food is produced in urban settings.

Chapter 5: Economic and Market Potential

Algae-based nutrition systems are not only a solution to urban food insecurity but also a major opportunity for economic development. As more cities explore sustainable food production, the commercial potential of algae continues to grow. From small-scale entrepreneurs to larger urban agriculture initiatives, this space is opening new paths for income generation, job creation, and innovation.

Urban agriculture entrepreneurs are uniquely positioned to benefit. Algae cultivation systems can be set up in small spaces like rooftops, basements, balconies, or shipping containers. This low entry barrier means individuals or cooperatives can launch micro-enterprises with modest investment. Unlike traditional farming, algae production is not seasonal and can be harvested throughout the year. This steady production cycle makes it easier for urban farmers to plan, budget, and scale their operations.

Several commercial products already use algae as a core ingredient. Spirulina and Chlorella, for instance, are sold in powder, tablet, or liquid form in supermarkets and health stores. They are also added to smoothies, protein bars, and even pasta. The growing interest in plant-based, sustainable nutrition has made algae a preferred option for consumers looking for alternatives to meat or soy-based proteins.

Beyond direct human consumption, algae is gaining ground in other markets. It is used in animal feed, especially in poultry and aquaculture. Algae-based feed is rich in protein and omega-3, which improves the health of livestock and fish. It also enhances sustainability by replacing soy, which often involves deforestation and long transport routes. This creates opportunities for algae producers to supply local farms and fishponds with fresh, nutrient-rich feed at a lower carbon footprint.

Algae is also used in cosmetics, bio-packaging, and fertilizers. These additional applications increase the market flexibility of algae producers, allowing them to tap into different revenue streams. A single algae-growing unit can support multiple product lines, which spreads risk and increases profitability.

In terms of cost-effectiveness, algae systems require fewer inputs than traditional crops. Water is recycled within the system, and algae grow quickly, allowing frequent harvests. Once the setup is installed, maintenance costs remain low. Modular designs and automation help reduce labor and energy needs, making it suitable for areas with limited infrastructure. For cities looking to reduce food imports or create local food security buffers, algae offers an affordable and scalable solution.

Job creation is another significant benefit. Algae systems need operators, technicians, product developers, marketers, and educators. In schools, algae labs can teach students about biology, nutrition, and entrepreneurship. In community centers, they can train unemployed youth or women groups to run and manage algae units. For local governments, supporting algae start-ups can stimulate inclusive economic growth and encourage innovation in urban food systems.

Public-private partnerships can play a role here. By offering grants, tax incentives, or access to public rooftops, cities can encourage entrepreneurs to launch algae projects. In return, these businesses provide jobs, increase food access, and contribute to climate goals.

Demand is rising steadily. As health-conscious consumers turn to superfoods, and as climate concerns push for alternatives to meat and soy, algae fits both needs. Its nutritional profile, sustainable production, and wide range of uses make it a smart product for the modern market. By establishing urban-based supply chains, entrepreneurs can deliver fresh, local algae-based products while keeping costs and emissions low.

In conclusion, algae production holds strong market potential and offers a path toward economic inclusion in urban areas. From micro-businesses to city-wide programs, it creates jobs, diversifies food products, and supports a sustainable circular economy. For urban agriculture to thrive, algae must be part of the conversation not just as food, but as a tool for economic transformation.

Chapter 6: Case Studies and Pilots

Several cities around the world have already started exploring algae-based nutrition as part of their urban food strategies. These real-world examples show how algae can be integrated into local food systems, create jobs, and improve access to nutritious food. These projects also highlight the power of partnerships between NGOs, local governments, and private companies.

In Paris, France, an algae cultivation project was launched on the roof of a school in the 13th arrondissement. Using vertical photobioreactors, the system produces spirulina year-round. The harvested algae is used in school lunches and sold to local markets. This project was initiated by an environmental NGO working with the city's urban farming program. It serves as an educational platform, teaching students about sustainable food production while helping reduce the school's environmental footprint. The small-scale pilot proved that rooftop algae systems are viable in dense urban areas, and plans are underway to replicate it on other public buildings.

In Nairobi, Kenya, a youth-led cooperative supported by a local NGO has set up modular algae farms in informal settlements. The goal is to provide affordable nutrition and empower unemployed youth. Using low-cost tanks and local materials, the project produces spirulina for community consumption and small-scale sales. Training and mentorship are provided, helping the youth build skills in farming, business, and marketing. Early results show improved nutrition among participating households, especially for children and nursing mothers. The algae is sold in sachets or added to local foods like porridge.

In the United States, a company in Brooklyn, New York, developed a community algae hub in a converted warehouse. The startup grows spirulina and chlorella in enclosed tanks and supplies them to local grocery stores, juice bars, and meal prep services. It has created new green jobs and attracted investment from food tech partners. The project also runs workshops for residents and schools, raising awareness about sustainable nutrition. This model shows how private companies can make algae production part of a profitable urban food business while maintaining strong community ties.

In Dhaka, Bangladesh, an NGO partnered with a university and a biotech company to pilot algae production in slum areas. The focus was on reducing malnutrition among children. Algae was grown in simple glass tubes placed on rooftops and in schoolyards. The harvested spirulina was added to meals served in community kitchens. After six months, a health study showed measurable improvement in child growth and energy levels. The project also trained local women to manage the algae systems, providing them with steady income.

These case studies have a few common features. First, they all used urban-friendly technologies like modular tanks, vertical systems, and rooftop units. This shows that algae cultivation does not need large plots of land or expensive infrastructure. Second, most of these projects involved partnerships between governments, NGOs, companies, or universities. These collaborations provided funding, technical support, and community trust. Third, the impact was clear. Whether it was improved nutrition, job creation, or education, each project contributed positively to its local food system.

The lessons from these pilots show that algae is not just a theoretical solution. It works in practice, even in areas with limited space and resources. The key is local adaptation using what's available, training local people, and building systems that fit the community's needs. With support and scale, these models can be expanded to more cities, helping meet urban nutrition and sustainability goals.

In summary, case studies from Paris to Nairobi and Dhaka to New York prove that algae-based nutrition can be integrated into urban environments. These pilots highlight the value of partnerships and local engagement. They also show that algae has the potential to improve health, create jobs, and strengthen food resilience in cities.

Chapter7: Policy and Institutional Support

For algae-based nutrition to thrive in cities, strong policy and institutional support is essential. While technology and entrepreneurship drive innovation, it is the role of local governments and institutions to create a supportive environment where these systems can grow, reach the public, and become part of long-term food strategies.

City governments play a central role in promoting sustainable urban food systems. They can include algae cultivation in urban planning by making space on public rooftops, schools, or unused buildings available for pilot farms. They can also ease zoning rules to allow vertical farms or modular algae units in residential or commercial areas. Through local food policy councils or urban farming boards, cities can include algae in broader food security discussions and funding programs.

Incentives can encourage private investment and community participation. These could include tax breaks, startup grants, or technical assistance for those who want to set up algae systems. Cities could also provide low-cost leases for rooftops or public land to nonprofits or small businesses working on algae nutrition. Integrating algae products into school meal programs or public health initiatives would also create stable markets and build trust.

Some cities already include urban agriculture in their climate or sustainability plans, but algae is often left out. Adding it as a recognized food crop would help align regulations, attract investment, and increase public visibility. For example, a city could add spirulina or other algae as an approved food item in its procurement policies. This would allow hospitals, prisons, or schools to buy locally grown algae-based foods.

Public awareness and education are equally important. Many people are unfamiliar with algae as a food source, and some may view it with skepticism. Public campaigns can help shift this mindset. City governments and NGOs can work together to create simple, relatable content about the benefits of algae its high nutrition, low environmental impact, and role in fighting food insecurity. Demonstrations, community tastings, and cooking workshops can show people how to use algae in everyday meals.

Schools and community centers can also serve as educational hubs. Including algae in science or health curricula helps children and parents learn about it early. Urban farms that grow algae can host open days or training sessions, giving residents hands-on experience with a new and promising food source.

In addition, partnerships between city governments, universities, and private companies can help with research, data collection, and scaling up successful models. Data on yield, impact, and cost helps shape better policies and attracts funding from international donors or environmental agencies.

To summarize, policy and institutional support can shape the future of algae in urban food systems. When cities provide space, funding, and favorable rules, algae production becomes easier and more accessible. When institutions educate the public and create demand, algae becomes part of daily life. With the right support, algae can move from a niche idea to a key tool in building healthier, more resilient cities.

Chapter 8: Conclusion and Recommendations

Algae-based nutrition offers a promising path toward building more sustainable, nutritious, and resilient urban food systems. It addresses several pressing challenges faced by cities today nutritional gaps, limited food production space, rising environmental concerns, and growing populations. With high levels of protein, essential vitamins, and omega-3 fatty acids, algae like Spirulina and Chlorella provide a powerful alternative to conventional food sources, especially where resources such as land and water are limited.

One of the key takeaways is that algae can be grown in compact, modular, and low-input systems, making it ideal for urban environments. From rooftop tanks to photobioreactors, cities can integrate algae cultivation without needing large plots of land or traditional farming infrastructure. These systems can thrive in schools, hospitals, public buildings, or even residential complexes, bringing fresh, nutritious food closer to where people live.

To integrate algae into city food strategies, a few key steps should be taken. First, cities need to recognize algae as a viable food crop in urban agriculture policies. This means updating zoning laws, building codes, and procurement guidelines to allow and encourage algae cultivation. Second, support must be provided for local entrepreneurs and community groups through grants, training programs, and access to space. Public-private partnerships can help bring algae to market in affordable and appealing forms. Third, education and awareness efforts should be launched to build public understanding and acceptance of algae-based foods.

In terms of innovation, the future of algae nutrition in cities will depend on continued research and development. New algae strains, better processing technologies, and creative food applications will improve taste, shelf-life, and affordability. Smart farming tools like sensors and AI can optimize growing conditions, helping small systems become more productive and energy-efficient. Integration with other green infrastructure like solar panels, rainwater collection, or composting can turn algae farms into multi-functional, eco-friendly spaces.

In closing, algae is not just a food of the future it is a tool that cities can start using now to make urban diets healthier and more sustainable. With the right support and vision, algae nutrition can play a central role in rethinking how food is grown, distributed, and consumed in the 21st century. It’s time for cities to act, bringing algae into the spotlight of food system transformation.

J W T **joules water team**

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WIPO/UN - **JWTeam set Industrial Proprerty: Geneva WIPO/UN**

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(12) International Application Status Report

Received at International Bureau: 01 February 2016 (01.02.2016)

Information valid as of: 17 June 2016 (17.06.2016)

Report generated on: 20 June 2025

(20.06.2025)

(10) Publication number:	(43) Publication date:	(26) P
WO 2016/092583	16 June 2016 (16.06.2016)	Englis
(21) Application number:	(22) Filing date:	(25) F
PCT/IT2015/000307	14 December 2015 (14.12.2015)	Italian

(31) Priority number(s):	(32) Priority date(s):	(33) P
MI2014A002124 (IT)	12 December 2014 (12.12.2014)	Priorit (in co Rule 1

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(54) Title (EN): METHOD FOR GROWING
MICROALGAE, AND DEVICE FOR
IMPLEMENTING SAID

METHOD

(54) Title (FR): PROCÉDÉ DE CULTURE DE MICROALGUES ET DISPOSITIF DE MISE EN OEUVRE DE CE PROCÉDÉ

(57) Abstract:

(EN): This invention relates to a method and to a device to implement said method, to cultivate microalgae and to obtain the simultaneous separation of oleic and protein parts, reducing the required space and drawing mainly from renewable energy sources.

(FR): La présente invention concerne un procédé, et un dispositif permettant de mettre en oeuvre ledit procédé, de culture de microalgues et d'obtention de la séparation simultanée des parties oléiques et protéiques, réduisant l'espace nécessaire et utilisant principalement des sources d'énergie renouvelable. Le procédé est caractérisé par le fait qu'il comprend les phases suivantes : •

ledit mélange aqueux, contenant ledit inoculum, suit un trajet (B) d'un point d'entrée (C) à un point de sortie (D), le long duquel il est irradié par un spectre de rayonnement approprié au développement et à la croissance desdites microalgues; • le long dudit trajet (B) des sels NPK (contenant de l'azote, du phosphore et du potassium) et du CO_2 y sont ajoutés, ces ajouts, conjointement à la diffusion dudit spectre de rayonnement, provoquant une croissance intense desdites algues ; • ledit mélange, fortement enrichi de micro-algues, est inondé d'ultrasons qui détruisent les algues adultes, les séparant en composants oléiques et protéiques, ladite action provoquant la formation d'un nouveau mélange aqueux dans lequel une fraction oléique et une fraction protéique sont présentes ; • ledit nouveau mélange aqueux est soumis à une séparation gravimétrique spontanée de telle sorte que : • une fraction oléique, plus légère, migre dans la partie supérieure dudit nouveau mélange ; • une fraction protéique, plus lourde, migre dans la partie inférieure dudit nouveau mélange ; • une fraction neutre composée presque exclusivement d'eau reste dans la partie intermédiaire dudit nouveau mélange ; · lesdites trois fractions sont prises individuellement. Le dispositif (A) est caractérisé par le fait qu'il comprend : • un bassin (1) adapté pour contenir ledit mélange aqueux ; • un ou plusieurs déflecteurs (3, 4, 5) montés de façon à délimiter un trajet (B) d'un point (C) à point (D), ledit ou lesdits déflecteurs (3, 4, 5) étant des panneaux diffuseurs du spectre de rayonnement homogènes, appropriés à la phase de culture ; • un moyen adapté pour fournir, audit mélange fluide, des sels NPK (sels d'azote, de phosphore et de potassium) et du CO_2, ledit moyen étant disposé le long dudit trajet (B) ; • un moyen (9) adapté pour produire des ultrasons, positionné au niveau du point final

(D) dudit trajet (B), lesdits ultrasons étant d'une puissance suffisante pour détruire les algues adultes en les séparant en composants oléiques et protéiques, donnant lieu à un nouveau mélange fluide dans lequel sont présentes une phase oléique, une phase protéique et une phase neutre ; • un moyen adapté pour diffuser ledit nouveau mélange fluide, afin de mettre en œuvre une séparation gravimétrique desdites phases oléique, protéique et neutre ; • un moyen adapté pour collecter séparément lesdites phases oléique, protéique et neutre.

International search report:

Received at International Bureau: 30 May 2016 (30.05.2016) [EP]

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(81) Designated States:

AE, AG, AL, AM, AO, AT, AU, AZ, BA,

BB, BG, BH, BN, BR, BW, BY, BZ, CA,

CH, CL, CN, CO, CR, CU, CZ, DE, DK,

DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD,

GE, GH, GM, GT, HN, HR, HU, ID, IL, IN,

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JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY,

MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

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Declarations:

Declaration made as applicant's entitlement, as at the international filing date, to apply for and be granted a patent

(Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate

Declaration of inventorship (Rules 4.17(iv) and 51bis.1(a)(iv)) for the purposes of the designation of the United

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NFT - Right for real role of actor on the "Dream.ZONE", in the desired mode: L(License), S(Sale/Buy), II(IncomeInvestment), JV(JoinVenture);

Objectives pursued are Local development with substantial recourse to local workers and labor, with great fervor and passion towards the necessary and urgent Ecological TRANSITION of the "Dream.ZONE", in which we commit to pouring the greatest effects of the activated capital; with sober recourse to resilience and endogenous capacity of the territory;

- Dream.ZONE (>1 Million People) of the desired shape and capacity, while always remaining withinthe limits of the Sovereign State from which it is pivot/center (State that is always hoped to be sober and constructive, as usually already sanctioned and recognized by our major communities such as

WIPO/UN and SDGs/UN);

- Through JWTeam and its projects/patents, open to anyone who wants to work for that "Dream.ZONE", through significant and/or representative operators (with NFW), as well as operational ones (with NFT, in the 4 different declinations: L, S, II, JV);

- 3 BIG transversal projects: GUPC-RE/Lab (Sustainable real estate redevelopment), GUPCHousingCare (Social and welfare redevelopment), MasterPlan (group of Industrial Plans); all interventions with a distributed&pervasive perspective that makes massive use of local work and endogenous resilience of the territory;

- 8 MINOR and vertical but still significant projects in various fields (Efficient pumps/generators, Urban MiniBiogas, Microalgae cultivation, Urban desalination, Agro&Sport, Separation and massive capture of pollutants, Effective dissemination and communications, Selective EMG diagnostics and capture of micro pollutants);

Subject to the NDA, consultancy and appropriate industrial property rights are available;

NFT/NFW (De.Fi.) - http://www.expotv1.com/JWT_NFW-BB.htm

Full Intellectual Property - http://www.expotv1.com/ESCP_Patent.htm

JWTeam - http://www.expotv1.com/ESCP_NUT_Team.pdf

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Patents & Goals from GostGreen:

UIBM/IT - JWTeam set Industrial Proprerty_Roma UIBM/IT

EPO/EU - JWTeam set Industrial Proprerty: Munich EPO/EU

WIPO/UN - **JWTeam set Industrial Proprerty: Geneva WIPO/UN**

SDGs/UN - https://sdgs.un.org/

Summary

In the face of rising urban populations and strained food systems, algae emerges as a revolutionary force in nutrition and sustainability. The **Algae Nutrition Vanguard** represents a bold shift toward integrating algae-based solutions into the urban food landscape—delivering high-impact nutrition while reshaping how cities produce, distribute, and consume food. Why Algae?

- **Nutrient density**: Rich in protein, omega-3s, vitamins, and antioxidants—algae offers a complete nutritional profile in a compact form.
- **Rapid growth**: Algae can be cultivated in vertical farms, rooftops, and bioreactors, requiring minimal land and water.
- **Climate-smart**: It absorbs CO_2 during growth, making it a carbon-negative food source.

Urban System Transformation

Algae-powered nutrition is redefining urban food systems through:

- **Decentralized microfarms** in schools, hospitals, and residential buildings—bringing fresh nutrition closer to consumers.

- **Functional food innovation**: Algae is being infused into snacks, beverages, and supplements tailored for urban lifestyles.
- **Circular resource loops**: Waste heat, greywater, and CO_2 from buildings are repurposed to fuel algae growth—creating closed-loop ecosystems.

Social and Environmental Impact

- **Food security**: Algae offers a resilient food source in areas vulnerable to supply chain disruptions.
- **Health equity**: Affordable algae-based products can combat malnutrition and support wellness in underserved communities.
- **Green jobs**: Urban algae cultivation opens new roles in biotech, agriculture, and education.\

- Vanguard Technologies

- **Genetic optimization** for taste, texture, and nutrient enhancement.
- **Smart harvesting systems** that automate algae collection and processing.
- **Blockchain traceability** for transparent sourcing and nutritional data.

Acknowledgments

The PBRC project is supported by MISE Grant MISE_0001427412_PBRC, recognized for its industrial utility, novelty, and inventiveness.

For more information, visit:

http://www.expotv1.com/LIC/MISE_0001427412_PBRC.pdf

Patent:

https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016092583

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