A World in Crisis

Algae Cultivator - PBRC toward SDGs/UN 7.1
(Target 7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services).

Sommary

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Chapter 1

A World in Crisis

In a not-so-distant future, Pakistan found itself in the grip of an energy crisis that had far-reaching consequences. Power outages plagued the nation, turning everyday life into a perpetual battle against darkness and discomfort. The erratic availability of electricity disrupted businesses, schools, and the lives of ordinary citizens.

But the energy crisis wasn't just about flickering lights and the inconvenience of not being able to operate household appliances. It was a multifaceted problem with grave implications. Pakistan's energy demands were surging with its rapidly growing population, and the nation's ability to meet those demands was dwindling. The situation was exacerbated by the fact that Pakistan primarily relied on fossil fuels for its energy needs, a practice that had detrimental effects on both the environment and the economy.

The air was thick with pollution, and the consequences of climate change were already making themselves felt. Extreme weather events, rising temperatures, and unpredictable monsoons were becoming increasingly common. The environment was suffering, and so were the people.

The energy crisis had pushed Pakistan to a crossroads, and the choices made in these trying times would shape the nation's future. Would Pakistan continue to depend on finite and polluting resources, exacerbating the environmental crisis, or would it seek innovative solutions that could not only provide sustainable energy but also help heal the environment?

As we dive into this story, we find a nation in the throes of uncertainty, where daily life is marked by the relentless struggle for power, both literally and metaphorically. But amidst this gloom, an unexpected source of hope emerges, a beacon of light in the darkness – a discovery that would change the course of Pakistan's energy landscape forever.

Chapter 2

A Magical Discovery

In the heart of Pakistan, nestled within the serene village of Greenville, lived a remarkable scientist named Dr. Amina. She was a visionary, deeply committed to finding innovative and sustainable solutions to Pakistan's growing energy crisis. Dr. Amina's modest but well-equipped laboratory was her sanctuary, where she spent countless hours experimenting, researching, and dreaming of a brighter future for her nation.

One sunny morning, as Dr. Amina meticulously observed her latest batch of experiments, she stumbled upon something truly extraordinary. For months, she had been focusing her research on microalgae, those tiny aquatic organisms known for their remarkable ability to photosynthesize and produce oxygen. Dr. Amina's work with microalgae was not merely academic; it was a fervent exploration of their untapped potential.

Through her dedication and unyielding curiosity, Dr. Amina had come to understand the nuances of microalgae, and their ability to thrive and adapt in a variety of conditions. What truly amazed her was their remarkable photosynthetic capacity and their potential for producing biofuels and clean energy. But she had a secret weapon in her laboratory: a patented technology known as the PBRC or Photo Bio Reactor Continuous.

The PBRC was a marvel of engineering and biological science, a sophisticated system that allowed for the controlled growth of microalgae on a large scale. Dr. Amina acquired the PBRC technology through her extensive network of connections and her tireless efforts to stay ahead in the world of sustainable energy research.

One fateful day, as she fine-tuned the parameters in her lab, she noticed something extraordinary. The microalgae, when subjected to precisely controlled conditions of sunlight and nourishment, exhibited an astonishing capacity to produce biofuels and clean energy at an unprecedented rate. It was as if they held the key to a boundless and magical source of power.

Dr. Amina was overwhelmed with excitement. She had discovered something that held the potential to transform Pakistan's energy landscape. She realized that the answer to the nation's energy crisis might lie in the miraculous powers of these tiny organisms.

At that moment, she knew she was standing at the threshold of a new era. The humble microalgae, with their incredible capacity for photosynthesis and energy production, had the potential to become the linchpin of a revolution. Dr. Amina envisioned vast landscapes of these microorganisms, spread across Pakistan's barren lands, capturing carbon dioxide from the atmosphere, producing renewable energy, and ushering in an era of green, sustainable power.

Chapter 2 marked the birth of a dream – a dream of turning Pakistan into a nation that harnessed the power of microalgae and the PBRC technology to conquer its energy crisis and reduce its carbon footprint. Dr. Amina's vision was one of hope and transformation, and it would require determination, collaboration, and innovation to bring it to life.

Chapter 3

The Birth of a Dream

Dr. Amina's laboratory, nestled in the tranquil village of Greenville, had now become the birthplace of a revolutionary dream. Her discovery of the incredible potential of microalgae, coupled with the innovative PBRC technology, filled her with a renewed sense of purpose.

Dr. Amina, a scientist with a heart for her homeland, envisioned a future where Pakistan would stand as a beacon of sustainability, free from the shackles of energy crises and the detrimental impacts of fossil fuels. She believed that the path to this dream lay in the humble microalgae and their remarkable capacity to produce clean energy.

As Dr. Amina meticulously planned the roadmap for her vision, she knew she couldn't walk this path alone. The enormity of the challenge required a collective effort, a collaborative movement that brought together individuals, scientists, environmentalists, and government officials who shared her dream.

Thus, she set out on a journey to gather allies, spread the message of sustainability, and inspire others to join her in realizing the dream of a greener, energy-independent Pakistan. She believed that collaboration and shared purpose would be the driving force behind the success of the project.

It was during one of her passionate presentations at a sustainability conference that she met Ali, a young and dynamic engineer who shared her vision. Ali was a tech-savvy individual with a deep love for his country and a desire to make a real impact. He was inspired by Dr. Amina's vision and believed that it was not only feasible but also necessary for Pakistan's future.

Their encounter marked a pivotal moment in the story. Dr. Amina and Ali joined forces, merging her scientific expertise with his engineering skills. Together, they founded the Green Energy Initiative, a movement aimed at harnessing the potential of microalgae to address Pakistan's energy crisis and transition the nation into a sustainable future.

The Green Energy Initiative rapidly gained momentum, drawing in individuals from all walks of life who shared the dream of a greener Pakistan. The movement was a testament to the power of a shared vision, and it became a symbol of hope and determination in a country that was yearning for change.

Chapter 3 was not only about the birth of a dream but also about the birth of a movement, an alliance of passionate individuals determined to take on the monumental task of transforming Pakistan into a green and energy-independent nation. Dr. Amina and Ali's journey had only just begun, but their vision and the power of collaboration were strong enough to light the way forward.

Chapter 4

Gathering Allies

With the formation of the Green Energy Initiative, Dr. Amina and Ali embarked on a mission to gather allies and build a network of like-minded individuals who would join them in their quest to harness the potential of microalgae and the PBRC technology. Together, they believed they could revolutionize Pakistan's energy landscape.

Dr. Amina and Ali's first step was to reach out to scientists and researchers across the country who had shown an interest in sustainable energy solutions. They organized seminars, workshops, and conferences, presenting their findings and sharing the immense potential of microalgae in renewable energy production. These events not only educated the scientific community but also inspired many to join their cause.

One of the early supporters of the Green Energy Initiative was Dr. Kareem, a renowned biologist with a deep understanding of microalgae. His expertise and research were invaluable in optimizing the growth and efficiency of microalgae in the PBRC systems. Dr. Kareem's involvement lent credibility to the project and attracted other scientists eager to contribute their

knowledge.

As word of the initiative spread, environmentalists and activists across Pakistan began to take notice. They recognized the dual benefit of using microalgae to produce clean energy while also mitigating the environmental damage caused by traditional energy sources. Environmental organizations offered their support, advocating for government incentives and policies that would promote the adoption of this green technology.

The government, too, was gradually becoming aware of the potential of microalgae in addressing the nation's energy crisis. Dr. Amina and Ali engaged in discussions with key government officials, presenting the economic and environmental advantages of the initiative. These talks led to initial funding to establish pilot projects in select regions of the country.

Throughout this chapter, the Green Energy Initiative's ranks continued to swell with individuals from various backgrounds, all driven by a shared vision of a sustainable Pakistan. Entrepreneurs, engineers, educators, and students joined the cause, each bringing unique skills and perspectives to the table.

The support and enthusiasm from these diverse allies energized Dr. Amina and Ali. They knew that, while the challenges were significant, their collaborative efforts could overcome them. The dream of transforming Pakistan into a green and energy-independent nation was no longer confined to their imaginations; it was taking root in the hearts and minds of many.

Chapter 4 showcased the power of collaboration and the ability of a shared vision to unite people from all walks of life. The Green Energy Initiative was on the brink of something extraordinary, and the journey had only just begun.

Chapter 5

The Grand Experiment

As the Green Energy Initiative gained momentum and allies from various backgrounds, Dr. Amina and Ali set their sights on realizing their vision through a grand experiment. They planned to select a vast stretch of arid land in the heart of Pakistan and establish a massive PBRC (Photo Bio Reactor Continuous) facility for the controlled growth of microalgae on a large scale. This experiment would serve as the proving ground for their innovative approach to energy production.

The selected location was an expanse of land in the province of Punjab, chosen for its ample sunlight and availability of water resources. The construction of the PBRC facility was a massive undertaking, requiring the combined effort of engineers, scientists, and laborers. It was a physical manifestation of their shared dream to transform Pakistan into a green and energy-independent nation.

Once the PBRC facility was complete, it resembled a labyrinth of interconnected transparent tubes and chambers, designed to maximize sunlight exposure and nutrient circulation. Dr. Amina and her team began the meticulous task of cultivating microalgae in the PBRCs. It was a delicate process that required precise control of environmental factors, from temperature and light to nutrient concentrations.

Day by day, the microalgae within the PBRCs multiplied rapidly, demonstrating their ability to thrive in the challenging Pakistani climate. It was a mesmerizing sight as the translucent green microorganisms swayed gently in the sunlight, performing their magic of photosynthesis.

The experiment was a resounding success. The microalgae not only thrived but exceeded all expectations in their capacity to produce biofuels and clean energy. The Green Energy Initiative has taken a significant step towards proving that microalgae could be the solution to Pakistan's energy crisis.

As the news of this successful experiment spread, it captured the attention of the nation. Pakistan, a country accustomed to stories of energy shortages, had a reason to hope. The promise of abundant, clean, and sustainable energy was no longer a dream but a reality, and the people began to see the potential for a brighter future.

The impact of this grand experiment was not limited to energy production. The microalgae, in their voracious appetite for carbon dioxide, began to play a crucial role in combatting climate change. They absorbed significant amounts of this greenhouse gas from the atmosphere, contributing to a reduction in carbon emissions.

Chapter 5 marked a turning point in the story. The grand experiment not only demonstrated the viability of the Green Energy Initiative but also offered tangible proof that microalgae when harnessed on a large scale, could alleviate Pakistan's energy crisis and address the environmental challenges posed by climate change. The dream of a sustainable Pakistan was no longer confined to the realm of theory; it had taken root in the arid soil of Punjab and was beginning to flourish.

Chapter 6

A Country Transformed

Chapter 6 picks up the story of the Green Energy Initiative as the success of their grand experiment begins to have a transformative impact on Pakistan. This chapter explores the far-reaching consequences of their innovative approach to clean energy production and carbon emissions reduction.

As the days turned into weeks and the weeks into months, the Green Energy Initiative's experiment continued to surpass all expectations. The vast PBRC facility, spread across the arid landscapes of Punjab, was a testament to human ingenuity and the incredible capacity of microalgae.

1. Exceeding Expectations: The microalgae thriving within the PBRCs were not just surviving; they were flourishing. They were producing a

significant amount of biofuels and clean energy, far more than anyone had predicted. The experiment demonstrated that microalgae when exposed to the right conditions, could be a game-changer in sustainable energy production.

2. Carbon Dioxide Absorption: However the impact of their experiment extended beyond energy production. The microalgae were voraciously absorbing carbon dioxide from the atmosphere, helping to combat climate change. Their capacity to act as a natural carbon sink was a remarkable discovery, offering the dual benefit of reducing carbon emissions while providing a source of clean energy.

3. Alleviating the Energy Crisis: As the experiment continued to yield positive results, Pakistan's energy landscape began to transform. The nation's reliance on fossil fuels was gradually diminishing. Frequent power outages, which had become a part of daily life for most Pakistanis, started to recede

into the past. A more stable and sustainable energy supply was emerging.

4. Improved Air Quality: The reduction in the burning of fossil fuels led to a noticeable improvement in air quality. The once-polluted skies over major cities began to clear. Breathing became easier, and the health of the population started to benefit from the cleaner air.

5. Economic Benefits: The economic impact of this transformation was significant. Pakistan was no longer burdened by the costs of importing fossil fuels, and it could allocate its resources to other critical areas of development. The burgeoning microalgae industry also created new jobs and opportunities for the people.

6. Inspiration for the World: Pakistan's success story with microalgae and the PBRC technology captured the attention of the world. Many countries struggling with similar energy and environmental

challenges saw hope in this innovative approach. They began to consider their initiatives, inspired by Pakistan's journey toward sustainability.

The chapter ends on a note of triumph and optimism. The Green Energy Initiative not only demonstrated the power of science and innovation but also showcased the ability of a dedicated group of individuals to change the course of a nation. The dream of a sustainable Pakistan was becoming a reality, and it was a dream that was not limited to Pakistan alone. It was an inspiration for the world to follow, a beacon of hope in a time of global environmental challenges.

Chapter 7

A Sustainable Pakistan

Chapter 7 delves into the continued success of the Green Energy Initiative and how it garnered support from the government and other key stakeholders, leading to a significant transformation of Pakistan into a sustainable, green energy hub.

1. Government Support: With the experiment's success, the government recognized the incredible potential of microalgae and the PBRC technology. Government officials acknowledged that this innovative approach could not only address Pakistan's energy crisis but also contribute to global climate change mitigation efforts. Consequently, the government decided to throw its full support behind the initiative.

2. National Scale-Up: With the government's backing, the Green Energy Initiative embarked on an ambitious plan to expand the project. Microalgae fields began to proliferate across the nation, transforming vast expanses of previously barren land into lush, green biofuel farms. These farms absorbed carbon dioxide from the atmosphere, making a significant contribution to Pakistan's commitment to reducing its carbon emissions.

3. Reduced Reliance on Fossil Fuels: The proliferation of microalgae farms also led to a noticeable reduction in Pakistan's dependence on fossil fuels. The nation was no longer at the mercy of fluctuating global oil prices, and energy security became a reality. Frequent power outages, once a significant challenge, became a distant memory.

4. Environmental Restoration: Pakistan's environment started to heal. The air became cleaner, and carbon emissions decreased as microalgae absorbed CO2.

The impact of climate change was not limited to Pakistan but had global implications. The nation was recognized as a leader in green energy innovation.

5. Economic Growth: The microalgae industry provided economic opportunities for the people of Pakistan. Job creation and new businesses flourished, particularly in rural areas where microalgae farming had taken hold. The income generated from these activities improved the quality of life for many.

6. Global Inspiration: Pakistan's remarkable success story served as an inspiration for other countries facing similar energy and environmental challenges. The Green Energy Initiative shared its knowledge and expertise, aiding the establishment of similar projects worldwide. The global community saw hope in the story of Pakistan's journey towards sustainability.

7. Education and Research: With the government's support, investments were made in education and research. Universities and research institutions collaborated with the Green Energy Initiative to further refine the microalgae technology, making it even more efficient and affordable.

As the chapter comes to a close, Pakistan has undergone a profound transformation. Dr. Amina and Ali, once dreamers of a sustainable Pakistan, were now celebrated as national heroes. Their vision, dedication, and unwavering commitment to the Green Energy Initiative have not only transformed the nation but also left an indelible mark on the world.

Pakistan's story was a testament to what was possible when science, innovation, and collective determination came together. The dream of a sustainable Pakistan, once a fragile idea in Dr. Amina's laboratory, had now become a powerful reality, proving that with the right technology and the will to change, even the most daunting challenges could be overcome.

Chapter 8

A New Hope

Chapter 8 explores the continued impact of the Green Energy Initiative on Pakistan and the world, as well as the personal journey and the evolving legacy of Dr. Amina and Ali.

1. Improved Quality of Life: As the sustainable energy infrastructure solidified, the lives of the people in Pakistan changed dramatically. Power outages, which had long been a source of frustration and inconvenience, became a thing of the past. Electricity was stable, and the people could rely on it for their daily needs, from running businesses to studying in well-lit schools.

2. Cleaner Air and Health Benefits: The improved air quality had immediate health benefits. Cases of respiratory illnesses and other pollution-related

health issues decreased. Families could breathe easier, and children grew up in an environment with cleaner, fresher air.

3. Economic Prosperity: The thriving microalgae industry contributed significantly to the economy. Job opportunities abounded in the microalgae farms, research institutions, and various support industries. Rural areas experienced an economic boost, reducing urban migration and fostering balanced regional development.
4. Environmental Healing: Pakistan's environment was on the path to recovery. Microalgae fields, in their role as carbon sinks, helped slow the advance of climate change. The reduced reliance on fossil fuels was making a significant dent in greenhouse gas emissions.
5. Government Commitment: The government continued to invest in the Green Energy Initiative, recognizing the long-term benefits of

sustainability. Policies were put in place to support renewable energy and environmental conservation efforts.

6. International Recognition: Pakistan's achievements in sustainable energy and environmental restoration had global recognition. The nation was now a sought-after partner in international efforts to combat climate change, offering its knowledge and experience to other countries facing similar challenges.

7. Dr. Amina and Ali's Legacy: Dr. Amina and Ali, the visionary founders of the Green Energy Initiative, had transitioned from passionate scientists to national icons. Their unwavering dedication to the initiative has not only transformed Pakistan but also inspired the world. Their legacy was one of determination and innovation.

8. Ongoing Work and Research: Dr. Amina and Ali did not rest on their laurels. They continued to work on improving the microalgae technology, making it even more efficient and affordable. Their research contributed to the global development of sustainable energy solutions.

As the chapter concludes, the story of Pakistan's journey towards sustainability is one of hope and triumph. It demonstrated that, even in the face of formidable challenges, a dream supported by science and the collective will of the people could become a reality. Pakistan's legacy was no longer one of energy crises and environmental degradation but a shining example of how innovation and determination could create a sustainable and prosperous future.

Chapter 9

The Legacy

Chapter 9 delves into the evolving legacy of Dr. Amina, Ali, and the Green Energy Initiative. It explores their continued efforts to improve and expand microalgae technology while reflecting on the impact of their work.

1. Celebrated National Heroes: Dr. Amina and Ali were now celebrated as national heroes. Their faces adorned posters and billboards across Pakistan. They received numerous awards, honors, and accolades for their vision and determination to transform the nation.

2. Educational Initiatives: Dr. Amina and Ali, recognizing the importance of education in sustaining their vision, established educational initiatives. Scholarships and programs were created to encourage young minds to pursue careers in

science, engineering, and environmental conservation.

3. Innovation and Collaboration: The Green Energy Initiative continued to innovate. Dr. Amina and Ali collaborated with experts and researchers worldwide to refine the microalgae technology. Breakthroughs in efficiency and cost-effectiveness further solidified the project's long-term viability.

4. Global Impact: The initiative's reach extended beyond Pakistan. Many countries looked to the Pakistani model of sustainable energy and environmental restoration as a source of inspiration. They sought Pakistan's guidance in implementing similar projects, marking a global shift towards green energy solutions.

5. Environmental Restoration: As microalgae fields expanded, Pakistan's environment continued to heal. The impact on climate change mitigation was

significant. Pakistan was at the forefront of international efforts to combat global warming.

6. Economic Growth: The microalgae industry provided economic opportunities not only within Pakistan but also through international partnerships. Exports of microalgae-based products, including biofuels and nutritional supplements, contributed to the nation's economic growth.

7. Hope for the Future: The Green Energy Initiative served as a symbol of hope for a sustainable future, both for Pakistan and the world. It was a testament to what could be achieved when dedicated individuals and nations worked together towards a common goal.

8. Challenges Ahead: Dr. Amina and Ali recognized that challenges would persist. They continued to advocate for policies that supported renewable energy and environmental protection, and they

urged the international community to unite in the face of climate change.

9. The Power of a Dream: The legacy of Dr. Amina, Ali, and the Green Energy Initiative was a testament to the power of a dream. Their journey from a small laboratory in Greenville to the transformation of Pakistan was a story of determination, innovation, and hope.

As the chapter concludes, it emphasizes that the work of the Green Energy Initiative was far from over. It was a continuing story of dedication to the principles of sustainability, environmental conservation, and clean energy. The dream of a sustainable Pakistan and a better world was a torch that Dr. Amina, Ali, and their allies carried forward, illuminating the path toward a brighter future for all.

Chapter 10

The Future

In the final chapter of our story, we journey further into the future to explore the long-term impact of the Green Energy Initiative, the lasting legacy of Dr. Amina, Ali, and their collaborators, and the vision of world-embracing sustainability.

1. Sustaining the Dream:

The Green Energy Initiative had evolved into a thriving and self-sustaining system. The microalgae farms, now spanning across Pakistan, were more efficient and productive than ever. Dr. Amina's and Ali's tireless efforts, in collaboration with scientists and engineers around the world, have led to the development of advanced PBRC technologies, enabling even more cost-effective and environmentally friendly energy production.

2. A Greener Nation:

Pakistan was no longer the nation grappling with power outages and environmental degradation. It was a beacon of green energy innovation. The once-barren lands had transformed into lush fields of microalgae, drawing tourists, researchers, and enthusiasts from across the globe. The nation had transitioned from an energy crisis to an energy exporter, sharing its excess clean energy with neighboring countries.

3. Global Inspiration:

Pakistan's success had a ripple effect. Nations across Asia, Africa, and beyond looked to Pakistan for guidance on implementing similar sustainable energy projects. Dr. Amina and Ali became global ambassadors of green energy, sharing their experiences and expertise in countless international forums, and collaborating on cross-border initiatives aimed at combating climate change.

4. Environmental Stewardship:

The microalgae fields played a crucial role in climate change mitigation. They continued to absorb vast amounts of carbon dioxide, contributing significantly to the global fight against greenhouse gas emissions. Pakistan's commitment to environmental stewardship was both a national and an international responsibility.

5. Economic Growth and Social Well-being:

The Green Energy Initiative had transformed Pakistan's economy. The nation's energy independence and robust microalgae industry have created thousands of jobs and spurred innovation in various sectors. Rural communities around microalgae farms thrived, and educational programs improved the quality of life for many.

6. Innovations Beyond Energy:

The innovations sparked by the Green Energy Initiative had far-reaching consequences. New technologies emerged in fields like agriculture, healthcare, and environmental monitoring, thanks to the research and development efforts in sustainable energy. Pakistan's scientific community was now a world leader in these areas.

7. Educational Transformation:

Educational institutions in Pakistan continued to flourish, producing the next generation of scientists, engineers, and environmentalists. Scholarships and research grants funded by Dr. Amina's and Ali's initiatives empowered young minds to think creatively and take on the world's most pressing challenges.

8. Government Commitment and Policies:

The government of Pakistan remained committed to green energy and environmental conservation. Comprehensive policies ensured the continued growth of the microalgae industry, with incentives for renewable energy projects and a focus on protecting natural resources.

9. A World United:

As the global community grappled with the consequences of climate change, the success of the Green Energy Initiative inspired nations to set aside differences and work together. International agreements and collaborations emerged, strengthening the world's resolve to transition to sustainable energy sources.

10. A Renewed Vision:

Dr. Amina and Ali, now in their senior years, looked back on their journey with gratitude and pride. They continued to work on improving the technology they had pioneered, embracing new challenges with the same passion and dedication.

11. The Legacy of Hope:

The legacy of Dr. Amina and Ali was not merely about technology; it was about hope. It was a testament to the power of human determination, innovation, and collaboration. Their story was a reminder that even in the face of daunting challenges, a shared vision and unwavering commitment could lead to remarkable change.

12. The Future Beckons:

The future was bright, not just for Pakistan but for the entire world. The journey from a world in crisis to a world of sustainability was a testament to the potential of the human spirit. The Green Energy Initiative and its visionary leaders had shown that the path to a sustainable future was not a distant dream; it was a reality within our reach.

As the final chapter concludes, it leaves us with a sense of hope and a vision of a future where the challenges of energy scarcity and climate change are met with innovative solutions, determination, and collaboration. Dr. Amina, Ali, and the Green Energy Initiative had not just transformed a nation; they had offered the world a model for a sustainable, green, and prosperous future.

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joules water team
https://www.jwt-jwt.it/

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

(INNOVATION - Patents and Projects, with relevant BPs and StartKit Commercial Offers)

JWTeam

http://www.expotv1.com/ESCP_NUT_Team.pdf
Offers extensive support on Energy and Water Cycle, verse IP_S DGs /UN

Bibliography/Conclusion

Any reference to people and things is purely coincidental, as well as creative/imaginative and aimed at the common good (both in fiction and non-fiction texts). The

Owners/Inventors of the Editorial rights on the source Intellectual Property believe the contents do not misrepresent the essential objectives, which are expressed below, but above all in the official sources cited in the bibliographies. Patents are archived, granted and owned by authors who have issued the necessary editorial permissions. Each patent is well founded (legitimized by the relevant national legal bodies: UIBM/IT, EPO/EU, WIPO/UN, EAPO/RU, CNIPA/CN, InPASS/IN), understandable to professionals, and implementable according to the rights granted promptly; JWTeam reviews and oversees the dissemination of SDGs/UN, pronouncing itself with the pseudonym "Ghost GREEN".

Cultivator (MicroAlgae) from PBRC (source) :

Patent:

PBRC , https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016092583 (algae to food/feed/biofuel, in urban and periurban); view1

Italy: GRANT

GRANT
http://www.expotv1.com/LIC/MISE_0001427412_PBRC.pdf, ...mean "INDUSTRY (useful), NEW (no make before), INVENTIVE (teach some things)"mean "INDUSTRY (useful), NEW (no make before), INVENTIVE (teach some things)".

Abstract/Description - Patent:

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

Full Intellectual Property

http://www.expotv1.com/ESCP_Patent.htm

Full JWTeam Service

http://www.expotv1.com/PUB/JWT_Service_EN.pdf

Summary – Applications (to SDGs)

PBRC

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

MicroAlgae - generate oleic and protein components for Bio-Fuel and Feed / Food . PBRC is dedicated to algal cultivation, both for purposes useful for the oleic supply chain (energy, biodiesel, hydrogen , ...) and the protein supply chain (feed / food , cosmetics, pharmaceuticals, ...). Very compact system that uses only renewable energy, with large specific growth indices. with great flexibility and penetrability even towards urban and peri-urban settlements . Excellent solution for CO2 capture and disposal of NPK salts deriving from other processes (e.g. anaerobic digesters) . It offers significant contrast in load inorganic from metals contributing to performance on " Water cycle ".

Project: PBRC – Phto Bio Reactor Continuous

Objective : Launch a pre- assembly and testing site (procedures and manuals) for the production of tanks

Target: Prefabricated (CLS) companies, Operators in the power LED sector, Hydromechanics companies , Financial investors, Operators in the AGRO and BioGas / BioMethane sector

The project aims to activate a production site, from design to assembly (pro delivery and rapid assembly), with the development of production-oriented procedures agreed with the client (based on the products available for supply) and destinations of the outputs produced. The solutions rely on standard products from the water management and prefabricated market, LED products integrated with RES, assembled and tested with a view to optimizing the cultivation of algal strains functional to the commissioned objectives. In collaboration with internal and external laboratories, it will act as remote support for the installations in charge (EPC - Engineering , Procurement and Construction).

Summary: The proposed method consists of the following steps; an aqueous mixture containing an inoculum, i.e. a small quantity of microalgae to be cultivated, is introduced into a tank divided into two parts by a bulkhead . The mixture follows a sinuous path in the first part of the tank, along which it is irradiated by a radiation spectrum suitable for the development and growth of microalgae.

NPKx salts (containing nitrogen, phosphorus and potassium) and CO_2 are also added along the way , which promote algal growth. The mixture, highly enriched with microalgae, passes into the second part of the tank, where it is subjected to ultrasound which destroys the algae, separating them into oleic and protein components. This action causes the formation of a new aqueous mixture in which there is an oleic fraction, a protein fraction and a neutral fraction. The new aqueous mixture undergoes a spontaneous gravimetric separation in such a way that: a) the lighter oleic fraction migrates to the upper part of the new mixture; b) the heavier protein fraction migrates to the lower part of the new mixture; c) the neutral fraction, composed almost exclusively of water, remains in the intermediate part of the new mixture. The three fractions are taken separately. The neutral fraction is recycled containing inoculum for the starting aqueous mixture. The proposed device includes: a) a tank designed to contain the aqueous mixture; b) one or more bulkheads designed to delimit a path from an entry point to an exit point, said bulkheads being homogeneous diffusing panels of a radiative spectrum suitable for the cultivation phase; c) means designed to supply the fluid mixture with NPK salts (salts containing nitrogen, phosphorus and potassium) and CO_2, said means being arranged along said path; d) means designed to produce ultrasounds, positioned at the final point of said path, said ultrasounds being of sufficient power to destroy the algae by separating them into oleic and protein components, giving rise to a new fluid mixture in which an oleic phase, a protein and a neutral phase; e) means designed to spread said new fluid mixture, in order to carry out a gravimetric separation of said oleic, protein and neutral phases; f) means designed to separately collect the said oleic, protein and neutral phases.

This method and device have some advantages over traditional microalgae cultivation and extraction techniques. For example:

• They reduce the space required and adapt to urban and suburban logistics;

• They mainly exploit renewable and environmentally friendly energy sources;

• They obtain high growth rates and a continuous production cycle of the oil and protein fractions;

• They avoid the mechanical movement of the algal mass and its exposure to environmental thermal cycles;

• They limit the risks of biological and chemical contamination from the environment.

SDGs / UN_en - SDGs / UN_it Full Strategy to
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http://www.expotv1.com/ESCP_Hello.htm

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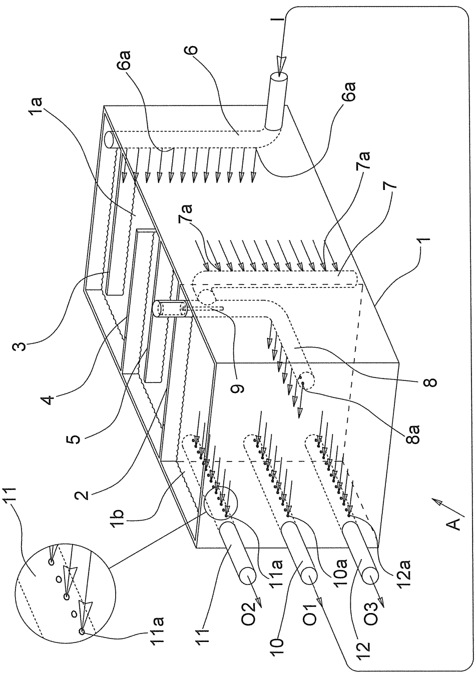
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Fig. 1

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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 CO2 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 CO2, 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.

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METHOD FOR GROWING MICROALGAE, AND DEVICE FOR IMPLEMENTING SAID METHOD

DESCRIPTION

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.

It is strongly felt the need to replace fossil fuels with other renewable and more compatible with the environment. The spinneret of algal crops is producing different solutions ("open ponds", tubular, bioreactors in greenhouses, etc.). The aim is to obtain concentrations of dry substance such as to justify the high costs of extraction. Another limitation suffered by the actual plants, derives from the choice to move the algal mass (process characterized by a high energy consumption), with actions necessary to keep it in suspension as well as to move it, to exchange its positioning in order to bring it to be conditioned by the light (exhausting its effectiveness after the first 20/30 cm of algal mass depth, or even less if thicker and when it would need more light for its exponential growth). In particular, it is not possible to bring a specific radiation spectrum, in a pervasive and deep way, with a drastic cost reduction for the mechanical movement of the culture medium. A limitation derives also from the possibility of biological and chemical contamination from the environment, because the algal mass is in a large contact with the environment itself (see the "open ponds" situations) and it is heavily exposed to the prevalent thermal cycles (often not suitable to the processes of growth) inside it. Some problems are often encountered even in the phase of collection and selection of the algal mass to be forwarded to the following processes, that proceeds through the massive processing of large volumes (by filtration and concentration) that, due to previous limitations (contamination and uncertain conditions of growth), remain at low concentrations. This invention overcomes many of these limitations, and reaches high rates of productivity.

The purpose of this invention is to propose a method and a device for implementing said method, respectively conform to claims 1 and 4, for the cultivation and the growth of microalgae present in small quantities (inoculum) in an watery mixture, obtaining the simultaneous separation of oleic and protein parts with relevant indices of growth and in continuous cycle, in tight spaces and compatible with the urban and suburban logistics.

The method is characterized in that it includes the following steps:

• said watery mixture containing said inoculum, follows a path from a point of entry to a point of exit, along which it is irradiated by a radiation spectrum suitable to the development and growth of the said microalgae;

• along said path they are added NPK salts (containing nitrogen, phosphorus and potassium) and C02, these additions, together with the diffusion of said radiation spectrum, causing an intense growth of said algae;

• said mixture, strongly enriched of microalgae, is flooded by the ultrasound that destroy the algae splitting them in oleic and in protein components, said action causing the formation of a new watery mixture in which a oleic fraction and a protein fraction are present;

· said new watery mixture undergoes a spontaneous gravimetric separation in such a way that:

• the oleic fraction, lighter, migrate in the upper part of said new mixture;

• the protein fraction, heavier, migrate in the lower part of said new mixture;

• a neutral fraction composed almost exclusively of water remains in the intermediate part of said new mixture;

• said three fractions are individually taken.

According to a preferred embodiment, the method in accordance to the invention further provides the step of measuring out the power of said ultrasound in such a way as to preserve a small amount of microalgae, said

microalgae being then recovered together with said neutral fraction that constitutes the inoculum of said watery mixture of departure. In this way, a continuous cycle for the production of said oleic and protein fractions is obtained.

The device is characterized in that it includes:

a basin fitted to contain said watery mixture;

• one or more baffles fitted to delimit a path from an initial point to a final point, said one or more baffles being diffuser panels of homogeneous radiation spectrum suited to the culture phase;

• means fitted to provide said fluid mixture, NPK salts (nitrogen, phosphorus and potassium salts) and $C0_2$, said means being arranged along said path (B);

• means fitted to produce ultrasound, positioned at the final point of said path, said ultrasound being of sufficient power to destroy the algae splitting in oleic and protein components, giving rise to a new fluid mixture in which there are present a oleic phase, a protein phase and a neutral phase;

• means fitted to diffuse the said new fluid mixture, in order to carry out a gravimetric separation of said oleic, protein and neutral phases;

• means fitted to separately collect said oleic, protein and neutral phase. Other characteristics, such as for example the ability to organize the linear development, in a configuration as a spiral (with a baffle separator to determine the second compartment, which acts as before), with the homogeneous optical diffusers that simultaneously feeds one stretch and the following lap, may be more appropriate to insert the device in existing structures, will be the subject of the dependent claims.

Other characteristics, such as for example the possibility to equip the second compartment with a device fitted to extract more effectively the oleic and the protein components, resorting to gravimetric principles in a state of rest, will be the subject of the dependent claims.

Other characteristics, such as for example the presence of

circumscribed mixers, will allow an adequate support to the processes of cultivation in the vicinity of the collection and support higher productivity, will be the subject of the dependent claims.

The use of a device according to the invention allows to produce components ready for specific following industrial uses, for example for the chemical and pharmaceutical industry.

It can also be used as a retrofit of FER plants (wind and photovoltaic) in agronomic compartments, absorbing redundancies and storing in raw materials, favouring the reclamation of the agronomic waste.

The invention will now be described for illustrative and not limitative purposes, according to a preferred embodiment and with reference to the drawings enclosed, wherein:

- Figure 1 shows the device according to the invention;

- Figure 2 is a plan view of the device according to the invention, illustrating the path of the fluid mixture in treatment.

With reference to figures 1 and 2, with (A) it is indicated a device according to the invention, fitted to cultivate microalgae and to separate the oleic and protein components. Said device (A) comprises a basin (1), predisposed for the phases of culture and extraction in the condition of communicating vessels, inside which it is positioned a first baffle (2) which divides said basin (1) in a first part (1a) and in a second part (1b). Inside said first part (1a) of the basin (1) it is present a plurality of alternate baffles (3, 4, 5) fitted to delimit a sinuous path (B) from a point (C) to a point (D), said alternate baffles

(3, 4, 5) being homogeneous diffuser panels of a radiatiation spectrum suitable to the cultivation phase, for example of the type described in the Italian patent application no. MI2014A002105, in the name of the same proprietors.

In order to be able to properly irradiate the mixture, the thickness of said flow is preferably not higher than 20 ÷ 30 cm. Furthermore, along the path (B) are present means (not shown) to provide the fluid mixture with NPK salts (nitrogen, phosphorus and potassium) and $C0_2$.

The tank (1) is preferably insulated outside and heated from below, for example by radiant systems to the floor (not shown) for supporting a slight excitation through convective motions so as to create the ideal conditions for the culture.

The flow of the mixture, watery based, containing the inoculum, including a small amount of microalgae to be cultured, indicated with the arrow (I), is introduced in the first part (1a) of the basin (1) through a first inlet pipe (6), vertically positioned in coincidence of the point (C) of the beginning of the path (B). The mixture comes out the tube (6) through a plurality of holes (6a) aligned along a generatrix of said first inlet tube (6).

The watery mixture, after the path (B), reaches the point (D) and runs into a second tube (7), through a plurality of holes (7a) aligned along a generatrix of said second tube (7).

In order to obtain a more regular flow, the inlet of the watery mixture takes place in the bottom part of the first inlet tube (6), while the output of said mixture takes place at the top of the second tube (7), according to a scheme of reverse return.

From the second pipe (7), the watery mixture passes into a third tube (8) and, from this, passes in said second part (1b) of the tub (1). The passage from the third tube (8) to said second part (1b) of the tub (1) takes place through a plurality of holes (8a) aligned along a generatrix of said third tube (8). The part of the third tube (8) in which it is present said plurality of holes (8a) is arranged horizontally and is positioned at about half the height of the basin (1).

In the top vertical position of said third tube (8), preferably in coincidence of the zone in which the second pipe (7) enters in said third tube (8), is positioned a sonotrode probe (9), the function of which will be described hereinafter.

The mixture leaving the third tube (8) passes through the second part (1b) of the basin (1) and reaches, on the opposite side, three outlet tubes, intermediate (10), upper (11) and lower (12) parallelly arranged to said third

tube (8).

Said three outlet tubes (10), (11) and (12) are provided with holes (10a), (11a) and (12a) respectively, aligned along a generatrix. In the enlarged detail of the upper tube (11) the holes (11a) are shown; said enlarged detail is representative of the holes made on all tubes inside the basin (1).

In the path from the third tube (8) to said three outlet tubes (11), (12) and (13), the mixture is subjected to the separation of the fractions oleic, that goes upwards, and protein, that goes downwards, leaving at half height a fraction composed almost exclusively of water. Proceeding towards the outlet tubes, the watery fraction is directed mainly towards the central tube (10), from which it comes out, as indicated by the arrow (O1). Similarly the oleic fraction, lighter, goes upwards and comes out from the upper tube (11), forming a flow (O2), while the protein fraction, heavier, goes downwards and comes out from the lower tube (12), forming a flow (03).

The intermediate flow (01) containing the inoculum, enriched by water, is recycled through said first inlet tube (6) for a new treatment.

The operation of the device (A), that is also the method of treatment according to the invention, is the following:

• the watery mixture containing the inoculum, substantially constituted by a small amount of microalgae, is introduced in the first part (1a) of the basin (1) through the first inlet tube (6);

• said mixture follows said path (B), from the inlet point (C) to the outlet point (D) along which it is irradiated by a radiation spectrum suitable to the development and the growth of the microalgae;

• along said path (B) they are added the NPK salts (containing nitrogen, phosphorus and potassium) in appropriate titre, and CO_2, these additions, together with the diffusion of an appropriate radiation spectrum, causes an intense growth of algae, said growth being able to reach a hourly rate of growth between 10% and 20%;

• arrived in the fourth tube (8), the mixture is flooded by the ultrasounds emitted by the sonotrode probe (9) that destroys the algae splitting

them in oleic and protein components, said division being suitably measured out through the adjustment of the power of the sonotrode, to preserve a small amount of algae;

• the resulting mixture, composed i.e. by a oleic fraction, a protein fraction and a small amount of not damaged algae, runs into the second part (1b) of the basin (1), where it undergoes a gravimetric separation;

• the oleic fraction, lighter, collects in the upper outlet tube (11) and form the output flow (02), while the protein fraction, heavier, collects in the lower outlet tube (12) and form the output flow (03);

· the neutral fraction, largely composed of water containing a small amount of not damaged algae, is recycled to the inlet tube (6) for a new cycle of culture.

The process (depending on the unicellular strain and of its chemical-biological structure) can be supported by flocculating or chemical agents to facilitate the separation and its collection (functional as well as to any subsequent treatments). The oleic (high) and the protein (low) components are extracted according to rates of flow correlated to the concentration of the relevant "solute" (detected by suitable densitometers), and the volumes of water must be properly replenished.

According to a preferred embodiment (not shown), said path (B) can be spiral-shaped, said path being delimited by panels, also in the shape of spiral, provided with optical diffusers for the radiative irradiation, that simultaneously feeds one stretch and the following lap.

In addition, along said path (B) they may be positioned localized mixers, for example of the type described in the Italian patent application no. MI2014A002103, in the name of the same proprietors, said mixers allowing an adequate support to the processes of cultivation in the closeness of the picking, obtaining greater productivity.

As it is clear from the foregoing description, in the described device, it is possible to obtain large amounts of oleic and of protein material from small amounts of algae. For a full ecological application of the device, the energy sources, to be used to favour the growth of the algae and their treatment, will be of renewable type.

The invention has been described for illustrative and not limitative purposes, according to some preferred embodiments. The person skilled in the art could devise several other embodiments, all included within the scope of protection of the enclosed claims.

CLAIMS

1. Method for the cultivation and the growth of microalgae present in small quantities (inoculum) in an watery fluid mixture, obtaining the simultaneous separation of the oleic and of the protein parts characterized by the fact to include the following phases:

- said watery mixture, containing said inoculum, follows a path (B) from an inlet point (C) to an outlet point (D), along which it is irradiated by a radiation spectrum suitable to the development and the growth of said microalgae;

· along said path (B) they are added NPK salts (containing nitrogen, phosphorus and potassium) and CO_2, these additions, together with the diffusion of said radiation spectrum, causing an intense growth of said algae;

• said mixture, strongly enriched of microalgae, is flooded by the ultrasounds that destroy the grown-up algae, splitting them in oleic and in protein components, said action causing the formation of a new watery mixture in which a oleic fraction and a protein fraction are present;

• said new watery mixture undergoes a spontaneous gravimetric separation in such a way that:

• an oleic fraction, lighter, migrate in the upper part of said new mixture;

• a protein fraction, heavier, migrate in the lower part of said new mixture;

· a neutral fraction composed almost exclusively of water remains in the intermediate part of said new mixture;

• said three fractions are individually taken.

2. Method for the cultivation and the growth of microalgae, according to the claim 1 , characterized in that the power of said ultrasounds is regualted in such a way as to preserve a small amount of microalgae, said microalgae being then recovered together with said neutral fraction that constitutes the inoculum of said watery mixture of departure.

3. Method for the cultivation and the growth of microalgae, according to claim 1 , characterized in that said spontaneous gravimetric separation is supported by flocculating or chemical agents.

4. Device (A) for the cultivation and the growth of microalgae present in small quantities (inoculum) in a watery fluid mixture, obtaining the simultaneous separation of oleic and proteic parts, characterized by the fact to include:

• a basin (1) fitted to contain said watery mixture;

• one or more baffles (3, 4, 5) fitted to delimit a path (B) from a point (C) to point (D), said one or more baffles (3, 4, 5) being homogeneous diffuser panels of radiation spectrum suited to the cultivation phase;

• means fitted to provide, to said fluid mixture, NPK salts (nitrogen, phosphorus and potassium salts) and CO2, said means being arranged along said path (B);

· means (9) fitted to produce ultrasounds, positioned at the final point

(D) of said path (B), said ultrasounds being of sufficient power to destroy the grown-up algae splitting them in oleic and protein components, giving rise to a new fluid mixture in which there are present a oleic phase, a protein phase and a neutral phase;

· means fitted to diffuse said new fluid mixture, in order to carry out a gravimetric separation of said oleic, protein and neutral phases;

• means fitted to separately collect said oleic, protein and neutral phases.

5. Device (A) for the cultivation and the growth of microalgae, according to the claim 4, characterized by the fact to include a separator baffle (2) suitable to divide said basin (1) in a first part (1a), in which the culture and the growth of microalgae takes place, and a second part (1b),

in which said gravimetric separation of said oleic, protein and neutral phases takes place.

6. Device (A) for the cultivation and the growth of microalgae, according to claim 4, characterized by the fact to include:

• a first inlet duct (6), vertically positioned in coincidence with said point (C) of the beginning of the path (B), the mixture coming out from said first pipe (6) through a plurality of holes (6a) aligned along a generatrix of said first inlet pipe (6);

• a second pipe (7), vertically positioned in coincidence with said point (D) at the end of the path (B), the mixture running into said second pipe

(7) through a plurality of holes (7a) aligned along a generatrix of said second outlet pipe (7);

the inlet of the watery mixture occurring from the lower part of said first inlet pipe (6), and the outlet of said mixture occurring from the upper part of said second outlet pipe (7), according to a scheme of reverse return.

7. Device (A) for the cultivation and the growth of microalgae, according to the claim 4, characterized by the fact that said one or more separatory baffles (3, 4, 5) are arranged in alternating sequence and define a winding path (B).

8. Device (A) for the cultivation and the growth of microalgae, according to the claim 4, characterized by the fact that said one or more separatory baffles

(3, 4, 5) are arranged in such a way as to define a spiral path.

9. Device (A) for the cultivation and the growth of microalgae, according to the claims 4 and 5, characterized by the fact that said means (9), fitted to produce ultrasounds, are positioned in coincidence with a pouring pipe (8) fitted to transfer the fluid mixture from said first part (1a) to said second part (1b) in which it is divided the basin (1).

10. Device (A) for the cultivation and the growth of microalgae, according to claims 4 and 9, characterized by the fact that said means to diffuse said new fluid mixture, so as to carry out a gravimetric separation of said oleic, protein and neutral phases, include a part of said pouring pipe (8), arranged horizontally at a first end of said second part (1b) of the basin (1), said fluid mixture passing through a plurality of holes (8a) aligned along a generatrix of said pouring pipe (8).

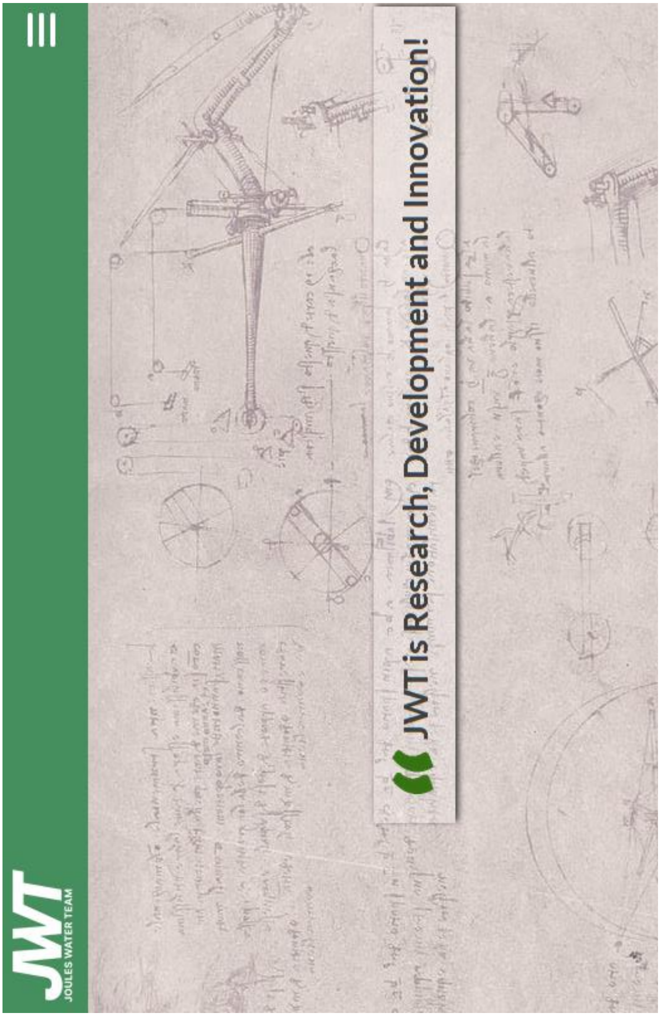
11. Device (A) for the cultivation and the growth of microalgae, according to the claims from 4 to 10, characterized by the fact that said means fitted to separately collect said oleic, protein and neutral phases include an

intermediate outlet pipe (10), an upper outlet pipe (1 1) and a lower outlet pipe (12), arranged horizontally at a second end of said second part (1 b) of the basin (1), said three outlet pipes (10), (11) and (12) being provided with holes (10a), (11a) and (12a) respectively, aligned along a generatrix.

12. Device (A) for the cultivation and the growth of microalgae, according to at least one of the claims from 4 to 11 , characterized by the fact to provide some localized mixers positioned along said path (B).

13. Device (A) for the cultivation and the growth of microalgae, according to at least one of the claims from 4 to 12, characterized by the fact to include means, positioned in coincidence with said second part (1 b) of the basin (1), fitted to spread flocculating and/or chemical agents fitted to favour the gravimetric separation of the fractions that constitute said new fluid mixture.

14. Device (A) for the cultivation and the growth of microalgae, according to at least one of the claims from 4 to 13, characterized by the fact to include means designed to insulate said basin (1) and to warm said basin (1) from the bottom so as to support a slight excitation through convective motions, to create the ideal conditions for the cultivation.



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