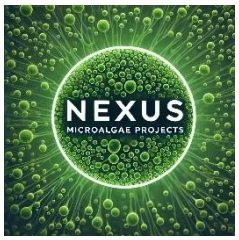

WATER PURIFICATION

Advantages of using microalgae in water purification

- **High efficiency**: Microalgae can remove up to 95% of the chemical oxygen demand in industrial wastewater[5].
- **CO2 capture**: During their growth, microalgae absorb carbon dioxide from the environment, contributing to the mitigation of climate change[5].
- **Oxygen production**: As a result of photosynthesis, microalgae release oxygen, improving the quality of the treated effluent[4].
- **Nutrient recovery**: Unlike conventional methods, microalgae not only remove pollutants, but also incorporate them into their biomass, allowing them to be subsequently used[2].
- **Generation of useful biomass**: The biomass produced can be used as fertiliser, organic feed or for the production of biogas[2].

Microalgae species used

Some of the most effective species in wastewater treatment include:

- Chlorella vulgaris
- Scenedesmus quadricauda
- Chlorella miniata
- Chlorella sorokiniana
- Tetraselmis sp.
- Chlamydomonas sp.
- Nannochloris sp.[9]

Applications and results

Microalgae have been shown to be effective in purifying various types of wastewater, including:

1. Urban wastewater
2. Industrial Wastewater
3. Tannery effluents[6]

In recent studies, a reduction of up to 95% in chemical oxygen demand and a significant removal of nitrogen and phosphorus have been achieved[59].

Future prospects

The use of microalgae in wastewater treatment is presented as a promising technology to achieve a more sustainable and efficient treatment. Their ability to combine the removal of pollutants with the production of useful biomass makes them an attractive option within the framework of the circular economy2. However, more research is still required to optimize processes and ensure consistent treatment quality under different environmental conditions.

Citations:

1. https://elpalmicultor.com/microalgas-una-alternativa-biotecnologica-para-la-depuracion-de-aguas-residuales-y-la-recirculacion-de-nutrimentos-al-suelo/
2. https://www.wearewater.org/es/insights/microalgas-biotecnologia-para-el-saneamiento-universal/
3. https://repositorio.cientifica.edu.pe/handle/20.500.12805/1417
4. https://quimica.unam.mx/buscan-utilizar-microalgas-como-sistema-de-tratamiento-para-aguas-residuales/
5. https://www.muyinteresante.com/naturaleza/60957.html
6. https://dialnet.unirioja.es/descarga/articulo/8397299.pdf
7. https://acofipapers.org/index.php/eiei/article/view/2324
8. https://www.cajamar.es/storage/documents/microalgas-1444391623-ca345.pdf
9. https://repository.unad.edu.co/bitstream/handle/10596/12170/91541023.pdf
10. https://riunet.upv.es/bitstream/handle/10251/183751/PachesGonzalez%20-%20Uso%20de%20las%20microalgas%20para%20depuracion%20de%20agua.pdf?sequence=1
11. https://theconversation.com/depuradoras-de-microalgas-ahorran-energia-absorben-co-sub-2-sub-y-producen-fertilizantes-sostenibles-162808
12. https://cordis.europa.eu/article/id/450006-sewage-cleaning-microalgae-offer-a-green-way-to-make-blue/es

EFFICIENCY

Microalgae work efficiently in the wastewater treatment process through several mechanisms:

1. Nutrient absorption: Microalgae assimilate nutrients such as nitrogen and phosphorus present in wastewater, using them for growth and reproduction12. This reduces the load of these elements in the water, reducing the risk of eutrophication.
2. Photosynthesis and oxygenation: During photosynthesis, microalgae produce oxygen, which is released into the water13. This oxygen promotes the growth of aerobic bacteria, forming a microalgae-bacteria consortium that improves treatment efficiency.
3. Removal of pollutants: Microalgae are capable of absorbing and biodegrading various pollutants, including organic matter, heavy metals and emerging pollutants15.

4. CO2 capture: When photosynthesizing, microalgae capture CO2 from the environment, contributing to the mitigation of climate change25.
5. Bioadsorption and bioaccumulation: Microalgae can remove contaminants through bioadsorption, biodegradation and biouptake processes5.

The purification process with microalgae is highly efficient. In one day, they can reduce up to 90% of organic matter, 95% of nitrogen and 50% of phosphorus in treated water6. In addition, species such as Chlorella vulgaris and Scenedesmus dimorphus have demonstrated an efficacy of more than 95% in the bioremediation of ammonia and phosphorus7.

This treatment method offers significant advantages over conventional systems:

- Energy saving: As it does not require mechanical aeration, energy consumption is considerably reduced3.
- Production of useful biomass: The microalgae biomass generated can be used as fertiliser, organic feed or for the production of biogas24.
- Sustainability: The process is aligned with the principles of the circular economy, allowing the recovery and reuse of resources2.

In short, microalgae offer a comprehensive and sustainable solution for wastewater treatment, combining the efficient removal of pollutants with the production of valuable resources and additional environmental benefits.

Citations:

1. https://cognitaconecta.com/tratamiento-de-aguas-residuales-mediante-microalgas-un-enfoque-sostenible/
2. https://www.wearewater.org/es/insights/microalgas-biotecnologia-para-el-saneamiento-universal/
3. https://tecnoalgae.com/tratamientos-de-aguas-residuales/
4. https://theconversation.com/depuradoras-de-microalgas-ahorran-energia-absorben-co-sub-2-sub-y-producen-fertilizantes-sostenibles-162808
5. https://quimica.unam.mx/buscan-utilizar-microalgas-como-sistema-de-tratamiento-para-aguas-residuales/
6. https://otraeconomia.com.ar/2023/10/05/asi-funciona-la-primera-planta-de-tratamiento-de-aguas-con-microalgas/
7. https://repository.unad.edu.co/bitstream/handle/10596/12170/91541023.pdf
8. https://www.aguasresiduales.info/revista/articulos/tratamiento-y-valorizacion-de-aguas-residuales-mediante-microalgas