

Final Report

Project acronym:ENVALGRA

Project number:5068

M-ERA.NET Call 2017

Period covered: 01/01/2018 to 31/08/20220

*Refer to beneficiaries when filling out this report.
To be completed by the project coordinator only.
Minimum font size is 11 pt.*

Coordinator:

Jesús Fidel Delgado | fdelgado@neoalgae.es | NEOALGAE, S.L. | Spain

2. Publishable project summary

Extracted oil from microalgae has taken great attention for industrial-scale production of carbon-neutral biodiesel and brought new insight in renewable energy and sustainability. ENVALGRA aimed at the developing of innovative, environmentally friendly microalgae oil-based functional fluids modified with graphene nanosheets (GNS). The main innovation of ENVALGRA project is that it had combined microalgae oil, graphene nanosheets (GNS) synthesized by applying chemical and thermal treatments, and other additives to develop functional fluids with enhanced tribological properties compared to existing ones based on water or vegetable or mineral oil, more sustainable and environmentally friendly and with lower risk of occupational exposure.

NEOALGAE (Spain) has been the project coordinator and responsible of selecting microalgae and developing cultivation and oil extraction and purification processes in order to obtain microalgae oil suitable to be used as functional fluids base. It also carried out a case study in a relevant, industrial environment to validate the use of the functional fluid as cutting fluid in high speed machining processes.....

SVMAC (Spain) has been responsible for the industrialisation of the microalgae oil production process, by designing and pilot-scale testing of the industrial-scale process. It has been also in charge of the formulation and tribological characterisation of the functional fluids , the definition of the homogenisation process and performing finite element analysis (FEA)to simulate the behavior of the functional fluids when used as cutting fluids.

NANOGRAFEN (Turkey) has been focused in the study of graphene nanosheets synthesis conditions at lab scale, their characterisation and the design of scaling-up of the graphene production process.

LIST (Luxembourg) has been focused in the evaluation of the environmental impacts of the newly developed functional fluids, in terms of holistic potential impacts via Life Cycle Assessment (LCA) methodology and of toxicity risks on human and aquatic ecosystems.

The innovative fluid produced with microalgae oil and graphene, improves the heat transfer from the hot spot (tool) to the fluid and, to the same extent, the transfer to the material of the workpiece and the heat flow transported. It lower viscosity improves the velocity profile in the vicinity of the wall (interface with tool and part) and the fluid has a layer faster limit than commercial functional fluid. The higher conductivity means that the transit of energy from the tool to the part takes place in less length and that the heat is conducted much more easily towards the material. This new functional fluid is clearly better than the traditional fluid since it extracts a calorific power of around six (6) times greater. In other words, it protects the tool more by evacuating more heat.