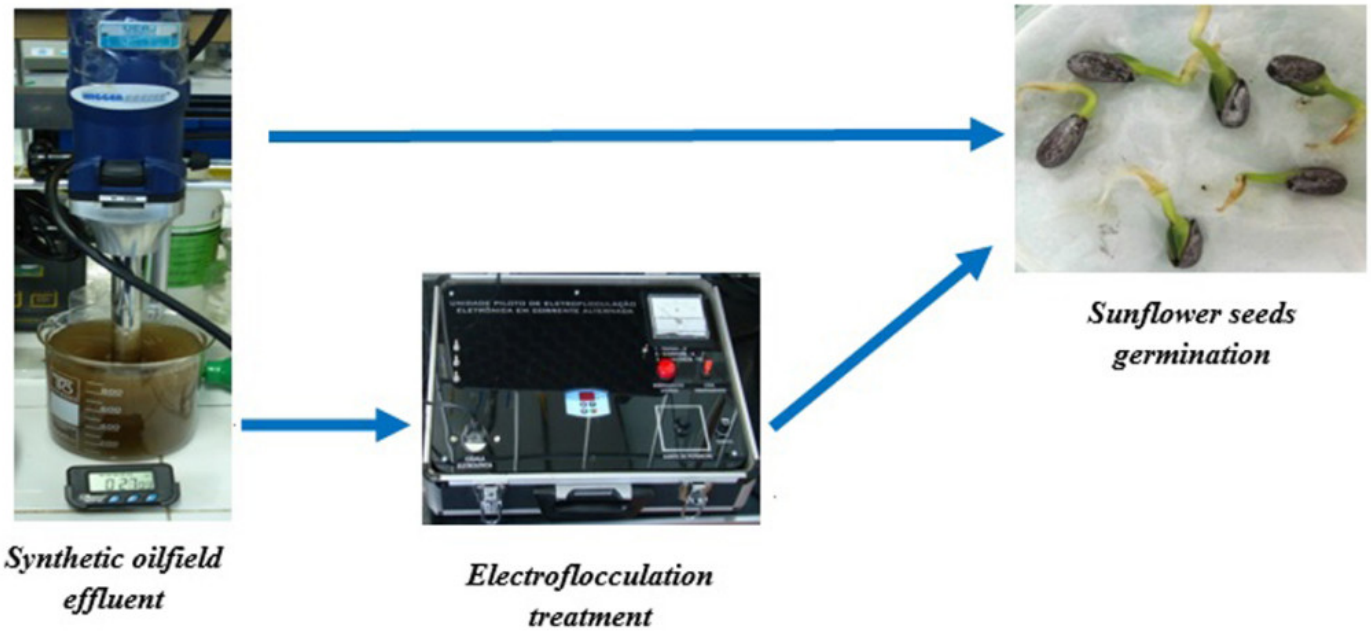
Effects of untreated and treated oilfield produced water on seed germination

Currently, about 70% of water consumption is dedicated to agricultural irrigation and the growing use of bioenergy tends to aggravate water scarcity. The oilfield produced water is produced in large quantities in onshore and offshore oil exploitation. The amount of water produced depends on the extraction technology used, the reservoir characteristics and the rate of oil extraction. In some places, this volume may exceed tenfold the amount of oil produced. In addition, this effluent may contain various naturally toxic compounds and a high salt concentration. In this context, the reuse in irrigation of nonfood sunflower crops, such as the intended for biodiesel production, may be considered as a possible destination for this wastewater.



Chemical methods are the most widely used in the treatment of oilfield produced water. However, these technologies present troublesome filtration processes and requires the addition of hydrolyzing metal salts as coagulant reagents providing an incentive to explore other alternatives. Electroflocculation (EF) is a wastewater treatment process that involves the generation of coagulants "in situ" from an electrode by the action of electric current applied to these electrodes. The EF units are small, compact, require low maintenance and reduced operating costs when compared other flotation units.

Sunflower (*Helianthus Annuus L*.) is an important option for the farmers in systems involving crop

rotation as it is a short cycle plant with great adaptability to different soil and climatic conditions . Its economic importance is due to their wide application, both in food and nonfood crops, as the destined for biodiesel production. Sunflower is also considered a phytoremediation plant showing tolerance to irrigation with saline waters. This way, our study focused on the effects of untreated and treated by EF oilfield produced water on seed germination and early growth characteristics of sunflower.

Electroflocculation technique with alternating current, proved to be a promising alternative in the treatment of oilfield produced water, promoting high removal efficiencies of oils and greases (96%) and dissolved organic matter (94%). Different dosages used of untreated an EF treated oilfield produced water did not cause significant variations on seed germination percentage, speed of germination, germination index and biomass production, indicating that sunflower seeds can germinate in extreme media containing different oils and greases, dissolved organic matter and salts concentrations. On the other hand, when using untreated oilfield produced water, normal seedlings percentage and seedling vigor tended to decrease more intensely in higher oils and greases and dissolved organic matter , respectively, possibly due to oil and recalcitrant organic compounds toxic effects.

Thus, EF appears to be a viable technology for treatment of oilfield produced water to improve sunflower seedlings development, providing a friendly environmental alternative for the reuse of this wastewater, reducing its potential to harm water resources, soil and biota. Moreover, this technique requires low maintenance and reduced operating costs when compared to chemical methods.

Publication

Effects of untreated and treated oilfield-produced water on seed germination, seedling development, and biomass production of sunflower (Helianthus annuus L.).
da Costa Marques MR, de Souza PS, Rigo MM, Cerqueira AA, de Paiva JL, Merçon F, Perez DV.
Environ Sci Pollut Res Int. 2015 Oct