PhD Candidate Profile

Name:

José Daniel Márquez Güelfo

Research Group:

N/A

Research Centre:

Instituto de Investigación Marina (INMAR)

Department/School(s):

Department of Environmental Technology

College:

University of Cádiz, España

Supervisor(s):

Dr. Javier Moreno Andrés

Funding body:

N/A

Area (field) of study:

Environmental technologies in the maritime sector

Thesis Title:

Ship emissions treatment by a combination of Advanced Oxidation Processes and wet scrubbing

Abstract:

Marine engines are mainly fuelled by fuel-oil, which contributes to a significant amount of anthropogenic emissions of SOx, NOx and particulate matter that are harmful to human health and to the environment. The fuel-oil is one of the heaviest fractions in the distillation of crude oil and contains high amounts of sulphur if it is compared to other types of fuel that tend to be more expensive. In 2005, Annex VI of the MARPOL Convention came into force: Rules to prevent air pollution caused by ships. Among other issues, restrictions are established for the emissions of sulphur oxides (SOx). Thus, as of January-2020, the maximum sulphur content in marine fuels has been reduced from 3.5% to 0.50% (mass / mass). In addition, a limit of 0.10% is stablished for areas designated as Emission Control Areas (ECAs).

There are several options to comply with the restrictions, such as the use of fuels with lower sulphur content or the installation of exhaust gas cleaning systems, which are so-called scrubbers. Scrubbers can efficiently remove SOx, but barely retain NOx due to the low solubility of NO, which is the main compound among the nitrogen oxides generated in

combustion. In this regard, within CLEANSCRUB project we hypothesized that it is possible to remove NOx forms through an oxidation process, since oxidized NOx (NO2, N2O5, etc.) are more soluble in water.

Currently, the preferred option for large vessels is still using the cheaper high sulphur fuels, which supposes installing a gas scrubbing system. It is evidenced by the fact that between 2019 and 2020 more than 3,500 scrubbers have been installed. At present, there is little knowledge about the composition of scrubber effluents and the consequences of its discharge.

The CLEANSCRUB project aims to know in detail the chemical composition of scrubber waters, its toxic effect on marine organisms, and to propose solutions based on Advanced Oxidation Processes, in order to increase the simultaneous removal of SOx and NOx, and to reduce the impact of its discharge into the marine environment. With the collaboration of various entities that support the project, the specific cases of the Port of Cádiz and Palma will be studied. Using maritime traffic data, ship databases, and hydrodynamic information, the impact of scrubber spills in the specific port area will be modelled.

Collaborations:

N/A

Publications:

N/A

Presentations:

N/A