ABATEMENT OF ULTRAFINE PARTICLES AND ACID GASES BY ELECTROSTATIC SEAWATER SCRUBBING

C. Carotenuto[1], F. Di Natale[2], L. D'Addio[2], A. Lancia[2], A. Jaworek[3], A. Krupa[3], M. Szudyga[4], D. Gregory[5], M. Jackson[6], P. Volpe[7], S. Cimino[8], L. Lisi[8], A. Charchalis[9], R. Beleca[10], N. Mannivannan[10], M. Abbod[10], W. Balachandran[10]

luca.daddio@unina.it

[1] Department of Industrial and Information Engineering, Second University of Naples, Via Roma 29, 81031 Aversa (CE), Italy

[2] Department of Chemical, Material and Production Engineering, University of Naples Federico II, P.le Tecchio 80, 80125 Napoli, Italy

[3] Polish Academy of Sciences, Institute of Fluid Flow Machinery, Fiszera 14, 80952 Gdańsk, Poland

[4] Rafako S.A, Research and Development Office, ESP Division, Górnośląska str. 3A, Pszczyna, Poland

[5] Sustainable Maritime Solutions LTD, London, United Kingdom

[6] iXscient Ltd, London, United Kingdom

[7] Vessel Technical Service, Quarto (Naples), Italy

[8] Istituto di Ricerche sulla Combustione (IRC-CNR), P.le Tecchio 80, Napoli, Italy

[9] Gdynia Maritime University, Gdynia, Poland

[10] Brunel University, Dept. of Electronic and Computer Engineering, London, United Kingdom

We are presenting the results of experiments, performed within the activities of the Seventh European Framework Programme – DEECON, on the capture of ultrafine particles and acid gas produced by a two-strokes 40kW marine engine with a technology named Electrostatic SeaWater Scrubber (ESWS). ESWS consists in a scrubber where electrostatic interactions among charged particles and charged droplets allow capturing ultrafine particles, for which the collection mechanisms active in a simple wet scrubber (phoretic, Brownian and inertial contributions) are ineffective. Moreover, due to the seawater alkalinity, an ESWS exploits appreciable acid gases absorption capacities.

The experimental set up consist in an ESWS column of 3.5m height and 40cm diameter, equipped with a system to charge particles by negative corona and a unit to generate positive polarity electrified water spray by induction. A single cylinder engine was run with diesel with 0.67%$_w$ of sulphur content. The particle size distribution produced by the engine ranges between 10 and 120nm with two peaks at 15 and 86nm.

The experiments were carried out with a liquid-to-gas ratio in the range 0.60-1.2 kg/Nm^3. The spray charging potential was kept at -15kV, Sauter mean droplet diameter was 288μm and the mean droplet charge was about 5% of the maximum Rayleigh limit. The corona charging unit was exerted up to -20kV. Time evolution of particles and acid gas concentration were monitored at the scrubber exit. The experimental results showed that the particle abatement efficiency increases with the high voltage applied to the corona charger, with a maximum total number efficiency of about 91% at -20kV. The SO_2 shows a decrease with the increase of L/G ratio up to an abatement efficiency of 52%. As expected, negligible reductions of NO_x and CO content were observed.

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