ILS L'ONT FAIT

TEST FAP
TESTING OF A PARTICULATE FILTER SYSTEM ON HIGH-POWER SHIPS (VESSEL PIANA FROM LA MERIDIONALE)

La Méridionale

Région SUD
Marseille (13)

Beneficiary
LA MERIDIONALE

Partners
- *ADEME/Service Transport et Mobilité*
- *Région SUD*

Budget (VAT not incl.)
Overall cost: *4 463 k€*

Financing :
- *ADEME : 1 101 k€*
- *Région SUD : 500 k€*

Balance in figures
- *One vessel equipped PIANA for 2 engines*
- *two campaigns of measurements at sea in navigation*

Release date
2018

Why act

Presentation of the beneficiary and announcement of the action

Founded in 1931, La Méridionale is the historic shipping company in Marseille, providing a daily service of freight and passenger shipping between Marseille and Corsica, thanks to a fleet of ROPAX vessels (Girolata, Kalliste and Piana).
La Méridionale meets the requirements for quality management and continuous improvement of environmental performance. As such, the Company is ISO 9001:2008 and ISO 14001:2004 certified. In 2013 and 2019, La Méridionale won the Blue Charter trophy for its actions in favour of the environment, such as the electric shore connection (CENAQ), a pioneer in France and the Mediterranean Sea.

The TEST FAP project aims to demonstrate the possibility of capturing fine particulate matter by adapting a smoke treatment system, already used in onshore installations, for use on ships with high-powered diesel engines.

National and Local Context. Beneficiary challenges

Like many ports in the world, Marseille and the Corsican ports are ports in the city, implying a significant impact of the pollution of ships on the inhabitants (proximity). Currently, emissions of fine particulate matter from maritime transport are not regulated, neither at international level (IMO) nor at European or national level.

The challenge for La Méridionale is to experiment with a smoke treatment system that goes beyond the current maritime regulations (MARPOL 2020 regulations that deal with SO_2), with the objective of treating fine particles (mass measurements) and ultrafine particles (number measurement), a particularly sensitive subject in Marseilles, equivalent to the EURO5 standard, and a possible evolution of the system towards NOx treatment in the long term, in order to obtain ultimately a system equivalent to EURO6 or LNG (excluding CO_2).

ADEME action and support

The issue of fine particles is now central to the problems of atmospheric pollution and public health impacts. The marine sector is one of the contributors but unregulated.
ADEME therefore opened in 2018 a call for research projects (APR) CORTEA (Knowledge, Source Reduction and Air Emission Treatment) on the deepening of knowledge on the nature and concentration of fine particles (PF) emissions from maritime and inland waterway transport. Characterization of the effectiveness of fine particulate matter emission reduction systems for these uses was also expected.

The TEST-FAP project responds perfectly to this problem when it comes to maritime transport.

Presentation and results

After a phase of study and design with the various partners, the choice of La Méridionale was based on a dry smoke treatment system produced by ANDRITZ and using a reagent (sodium bicarbonate). The process system demonstrator was put into production and installed on the PIANA vessel. This was followed by a phase of commissioning, optimization, crew takeover and two emission measurement campaigns by a specialized company (CERTAM) with three representative types of fuel oil: diesel oil, HFO 1.5%S, HFO 2.5%S.

The project began in September 2018 and was completed in October 2019.

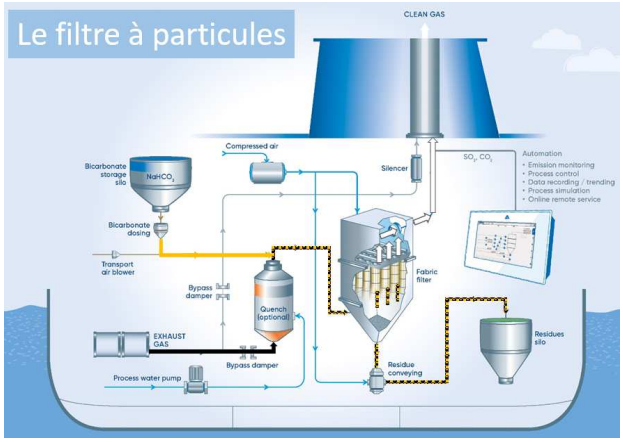
Technical specifications:
The system works with a reagent (sodium bicarbonate) injected into the exhaust gas, then captured by a bag filter (about 11 metres high by 6 metres wide and 12 metres long, weighing 60 tonnes) located on the upper deck between the ship's chimneys. It can process the exhaust gas of one of the four propulsion engines (9.5MW) and one of the three generators (1.5MW).

Figures report:
The measurements carried out by CERTAM have shown that the PIANA PFF (FAP) goes well beyond a "road" PFF in terms of fine particulate matter reduction, with a **result of more than 99.9% reduction, in particular ultrafine or nanoparticle (PM<1) particles.**
This system allows the vessel to comply with the regulations in force ashore, although none exists in the maritime sector. The second benefit is the reduction of SO_2, **allowing to go below 0.1% of sulphur** while using high sulphur fuel oil (HSFO). The system therefore allows La Méridionale to be ready in case of the establishment of a SECA zone in the Mediterranean sea, and this without any discharge at sea.

> *The pollution control system installed on the Piana perfectly meets the objectives in terms of efficiency on both particulates and SO_2. The ISO 23210 measuring system (PM1, PM2.5, PM10 and TSP) showed the **perfect efficiency of the filter (> 99.9%)** for the different particle size fractions.*
> *These results show that the system studied is comparable in abatement to a ceramic particulate filter of the automotive type and that it has an efficiency on SO_2 that is substantially as high **(>99%)** as that of a wet scrubber, the latter being totally ineffective on fine particles.*
>
> **David PRETERRE,**
> **Head of Air Quality Department - CERTAM**

Focus

Sodium bicarbonate (a neutral reagent for man and the environment) is injected at the engine outlet into the exhaust gas duct. It will first react chemically on the acid molecules (SOx) present in the gases throughout the exhaust gas duct, and then finish its run in a filter, called a bag filter. This filter consists of hundreds of "bags", on which the bicarbonate will settle, and form a mantle (called a cake) that will capture fine particles and heavy metals.



Reproducibility factors

The system allows LA MERIDIONALE to meet both MARPOL regulations on sulphur oxide emissions, but also to go further than the MARPOL regulations on fine particulate emissions. La Méridionale validates this technology and will complete the ship's retrofit in early 2021.

With this experience, La Méridionale now wishes to go further, by testing a system of treatment of nitrogen oxides (NOx) integrated directly into the FAP, ie without the addition of materials.
The project also benefited the filter manufacturer ANDRITZ and the reagent supplier SOLVAY, who were able to validate for the first time the design and efficiency of this system/process in the marine environment.

For ADEME, this experiment demonstrates the capacity of a post-treatment of ship exhaust gas, more effective and more environmentally friendly than the usual wet scrubber solutions.

FOR MORE INFORMATIONS

On the website of ADEME :
www.ademe.fr/

Website of the beneficiary
www.lameridionale.fr

ADEME website on ADEME air quality programmes
www.ademe.fr/ expertises/air-bruit/r

CONTACTS

Beneficiary
Christophe Seguinot
christophe.seguinot@lameridionale.fr

ADEME Transport and Mobility department
Philippe Cauneau
philippe.cauneau@ademe.fr

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