Compatibility of marine fuels containing alternative materials

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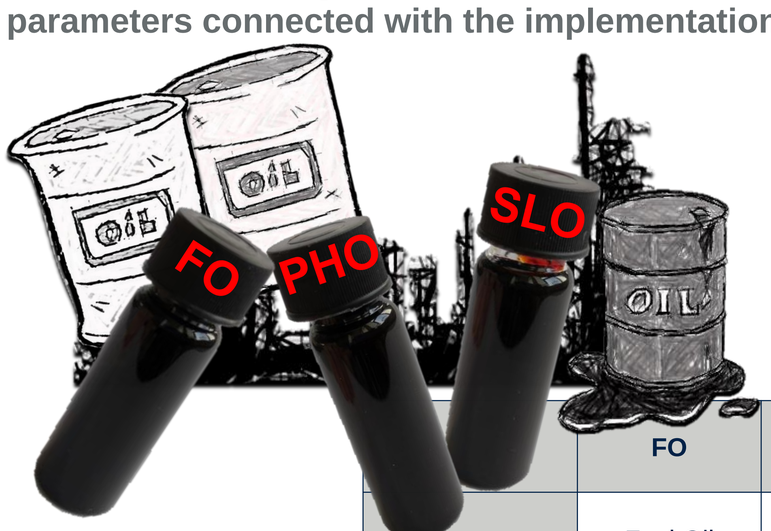
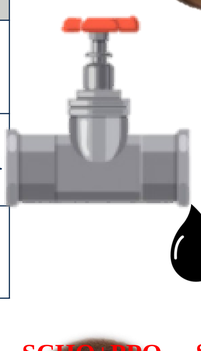
Introduction

Following the implementation of IMO 2020, problems with the incompatibility of blended low-sulfur fuels were found. These problems can lead to technological troubles during transport or storage and finally during the combustion of fuel in marine engines. The new implementation of IMO 2020 brought a drastic reduction of sulfur content in marine fuels on the deep seas from 3.5 to 0.5 wt%. The goal of this work was to investigate the compatibility of individual conventional and alternative materials. The first step included verifying the compatibility by spot tests and microscopic analysis before and after long-term storage as well as prediction of suitable mixtures from available conventional and alternative materials. In the second step the preparation of marine fuels from the compatible blends meeting the quality parameters of ISO 8217, was done. The third step was focused on finding suitable ratios of the conventional and alternative materials to produce marine fuels complying ISO 8217 standard and parameters connected with the implementation of IMO 2020.



	FO	SCHO	SLO	TPO	PPO	UCO	AF	Standard
	Fuel Oil	Steam Cracking Heating Oil	Slurry Oil	Tire Pyrolysis Oil	Plastics Pyrolysis Oil	Used Cooking Oil	Animal Fat	
Density at 15 °C [kg/m³]	1004	1110	899	938	1040	920	917	ASTM D 4052-18a
Sulfur [wt%]	2.70	0.06	0.97	1.00	0.04	0.00	0.02	ASTM D 4294



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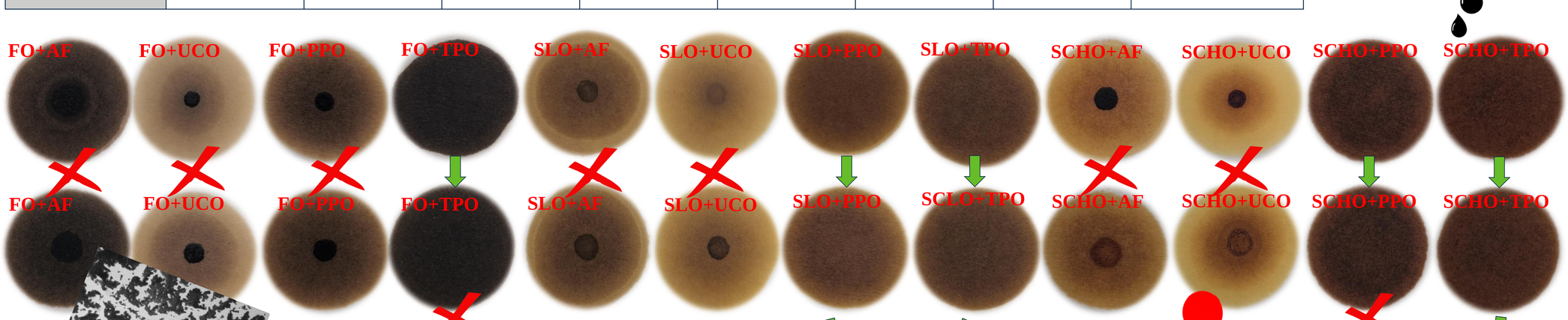

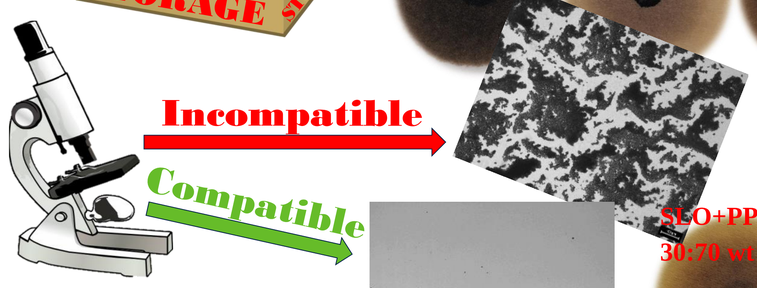

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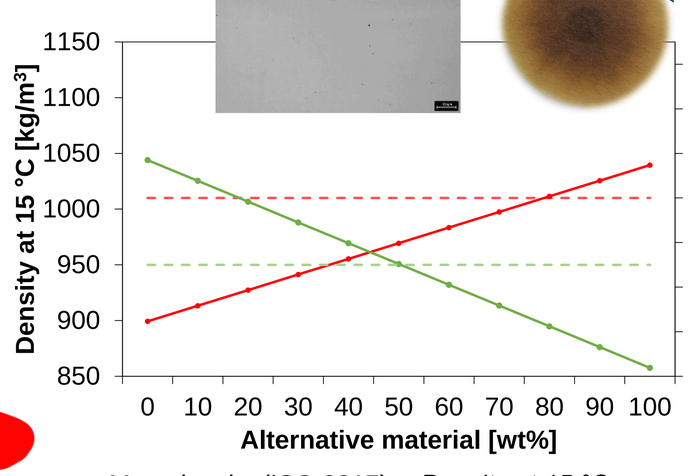

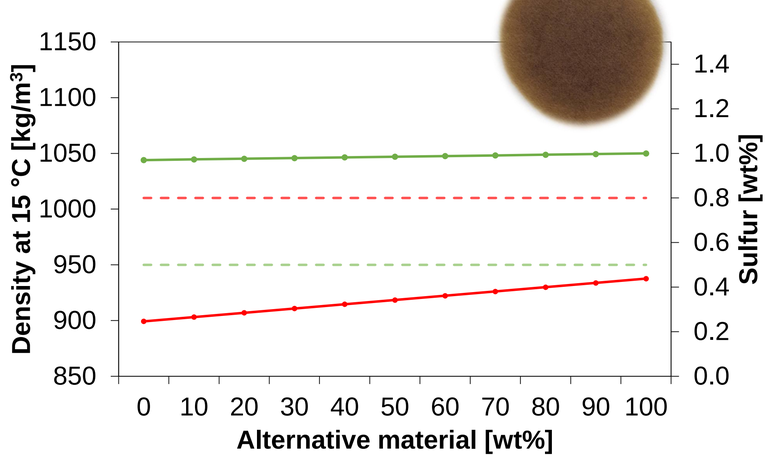

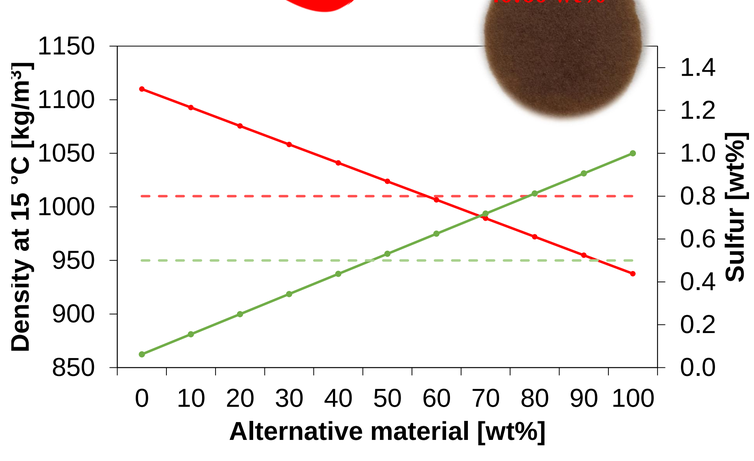

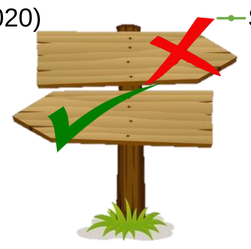

Conclusions

Mixtures of conventional and alternative materials in a ratio of 1:1 were subjected to long-term storage. Based on the compatibility results, which were monitored by spot tests and microscope, suitable "compatible" mixtures were selected. Based on the blending experiments and the evaluation of qualitative parameters according to ISO 8217 standard the following materials were identified as perspective for their industrial application.

The Steam Cracking Heating Oil + Plastics Pyrolysis Oil blend was predicted to exceed the density limits at 15 °C. The blend Fuel Oil + Tire Pyrolysis Oil could be prepared in any ratio, however, non-compliance with the limits for sulfur content was predicted. The mixtures Steam Cracking Heating Oil + Tire Pyrolysis Oil (40:60) and Slurry Oil + Tire Pyrolysis Oil (30:70) met all the quality parameters given by the ISO 8217 standard, but the sulfur content was exceeded in both cases. The mixture Slurry Oil + Plastics Pyrolysis Oil (30:70) met all the quality requirements of the ISO 8217 standard and at the same time the maximum limit for the sulfur content up to 0.5 wt% according to the new implementation of IMO 2020.

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