Analysis of the documents - modify the properties of heavy hydrocarbon fuels

shipboard fuel IEO-180 (INA HR)	N		formal standart	original sample	1	2	3	4	comment
density at 15 °C	1	kg/m3	<= 991	947.6	945.7	945.7	948.1	949.6	agree
kinematic viscosity at 50 °C	2	mm2/s	<= 180	<u>138.5</u>	<u>117.8</u>	<u>117.6</u>	129.1	136	<u>super</u>
aromaticity index	3	(CCAI)	<= 860	820	820	820	821	822	agree
total sulfur content	4	% m/m	<= 4.5	1.59	1.56	1.57	1.54	1.49	agree
flash-point	5	°C	>= 60	92.0	94	94	> 100	> 100	*
amount of sediment	6	% m/m	<= 0.10	0.02	0.05	0.04	0.03	0.04	**
amount of coke residue	7	% m/m	<= 15.0	<u>14.06</u>	<u>8.53</u>	<u>8.18</u>	<u>8.19</u>	<u>7.63</u>	<u>super</u>
flow point	8	°C	<= 30	+30	+24	+24	+21	+24	<u>super</u>
amount of water	9	% v/v	<= 0.50	0.1	0.05	0.05	<u>3</u>	<u>5.6</u>	agree
amount of ash	10	% m/m	<= 0.07	0.04	0.04	0.03	0.04	0.04	agree
amount of vanadium	11	mg/kg	<= 200	<u>125</u>	<u>122</u>	<u>120</u>	<u>115</u>	<u>112</u>	<u>super</u>
amount of sodium	12	mg/kg	<= 50	4.93	7.25	7.85	5.72	5.34	***
amount of Al + Si	13	mg/kg	<= 50	5	5	5	5	5	agree
energy value	14	MJ/kg	-	-	41.02	41.02	39.7	38.88	agree
			standart	no add	no add	no add	+3% w	+6% w	

Legend for understanding

0. A sample of the initial fuel.

1 - Fuel after the first stage of processing on the device TRGA - without any additives.

2. Fuel after the second stage of processing on the device TRGA - without any additives.

3. Fuel processed with the addition of 3% water.

4. Fuel processed with the addition of 6% water.

(the reason - the timpact evaluation of water on the fuel - a science experiment)

Comments :

<u>**1. Density at 15 °C</u>** - with change density completely agree, without additives density decreases slightly with the addition of water - growing smoothly.</u>

<u>2. Kinematic viscosity at 50 °C</u> – with change viscosity completely agree, without additives viscosity decreases with the addition of water - increases proportionately. (reduction of viscosity is 15%)
3. Aromaticity index - completely agree.

4. Total sulfur content - not sure in the level of sulfur content in the original sample.

5. Flash-point – Loss of light fractions in sampling during the processing of fuel and/or analysis - *.

Adding water to the fuel in the last two samples increases **alash-point** - completely agree. **6. Amount of sediment** – standart measuring error - ******.

7. Amount of coke residue - Proved by the ship practically. (reduction of coke is 40%)

8. Flow point – reduction viscosity (- 15%) and coke residue (-40%), reduces the flow point (- 4 C).

9. Amount of water - completely agree.

10. Amount of ash - completely agree.

For the type of fuel it is. For heavy fuels - we usually see a decline.

11. Amount of vanadium - completely agree. In processing the fuel TRGA vanadium may forms = V2O5 (Catalytic oxidation vanadium in the fuel) = VSO4 and/or VOSO4

Any binding vanadium useful for the prevention of sodium vanadate NaVO3 which is very dangerous for the engine. Sulfates of heavy metals can be easily removed by ship separator as their density in 2-3 times higher than the density of fuel. Reduction of free vanadium nearly 4%, so **reduction NaVO3 is 4%** too, so the reduction of refractory sludge in the engine by 4% (melting of NaVO3 is 630 degrees Celsius)

12. Amount of sodium – may be. Increase in soda suggests that sodium is associated with water and then will not form compounds with vanadium called vandanaty NaVO3. NaVO3 are refractory and cause destruction of the engine - ***.

13. Amount of Al + Si - completely agree.

14. Energy value – agree but... This analysis was conducted in a calorimeter bomb. Burning in a boiler or engine shows that a small amount of water with the fuel results in increased efficiency energy systems. But we do not support the idea of mixing water and fuel. This has been done for other purposes.

15.03.2013 Some illustrations below



Turkey, 2009, IFO 180, fuel source, standard, magnified image - 100

Turkey, 2009, IFO 180, fuel after processing in a homogenizer TRGA, magnified image - 100



Fuel IFO-180 after treatment an increase by 100 times

Ind

Below is a comparative analysis of the sulfur content of heavy fuel oil (M-100 or IFO 380) and hydrogen fuel oil emulsion, which contains 10% water - scientific experiment

IZVEŠTAJ O ISPITIVANJU br. 64/09

Naručilac, adresa: PD "PANONSKE TE-TO" D.O.O. Novi Sad, Termoelektrana-toplana Sremska Mitrovica; Jarački put bb, Sremska Mitrovica

Poziv na broj Zahteva naručioca, datum: Usmeni zahtev, 05.02.2009.

Zahtev evidentiran u Laboratoriji CH, broj i datum: 64/09, 09.02.2009.

Odeljenje Laboratorije CH: GOMA i CIA

Uzorci dostavljeni: 05.02.2009.

Analize završene: 06.02.2009.

Naziv (šifra) uzorka	Metoda	Rezultat		
TE-TO-SM-Mazut	Određivanje sadrzaja ugljenika, vodonika, azota i sumpora (i kiseonika) upotrebom instrumenta za elementalnu analizu Vario EL III	Sadrzaj ugljenika: 86,05% Sadrzaj vodonika: 12,10% Sadrzaj azota: 0,33% Sadrzaj sumpora: 2,60%		
	Određivanje kalorične vrednosti po metodi kalorimetrijske bombe i izračunavanje donje kalorične vrednosti JUS.B.H8.318*	Gornja kalorična vrednost: 43133,5 kJ/kg 10302,3 kcal/kg Donja kalorična vrednost 40637,1 kJ/kg 9706,0 kcal/kg		
Emulzija	Određivanje sadrzaja ugljenika, vodonika, azota i sumpora (i kiseonika) upotrebom instrumenta za elementalnu analizu Vario EL III	Sadrzaj ugljenika: 77,66% Sadrzaj vodonika: 12,12% Sadrzaj azota: 0,30% Sadrzaj sumpora: 1,99%		
	Određivanje kalorične vrednosti po metodi kalorimetrijske bombe i izračunavanje donje kalorične vrednosti JUS.B.H8.318*	Gornja kalorična vrednost: 38704,0 kJ/kg 9244,3 kcal/kg Donja kalorična vrednost 36211,6 kJ/kg 8649.0 kcal/kg		

Napomena (*): Metoda nije akreditovana za tečne uzorke. Prilozi Izveštaju: /.

Analitičar(i): dr Alas Cuetbouić i dr Snezana Trifunović

Fuel test, initially:

Water content inside fuel- 1,7%Sulphur content- 2,60%,

Fuel & water emulsion after treatment with TRGA-3G:

water content	- 11,7%
Sulphur content	- 1,99%

Obtained reduction of Sulphur was 23.5% versus the expected 10% due to the addition of water .

Please see attached the original analysis.



Laboratorija CH, IHTM - Centar za hemiju, Studentski trg 16, Beograd, tel./fax. 011/2636-061 E-mail: <u>depchem@chem.bg.ac.yu</u>

ZP05/P13 Strana 1 Ukupno strana 1

IZVEŠTAJ O ISPITIVANJU br. 64/09

Naručilac, adresa: PD "PANONSKE TE-TO" D.O.O. Novi Sad, Termoelektrana-toplana Sremska Mitrovica; Jarački put bb, Sremska Mitrovica

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Analitičar(i): dr Olga Cvetković i dr Snezana Trifunović

Tačnost, preciznost, ponovljivost i reproduktivnost u saglasnosti sa metodama ispitivanja. Rezultati ispitivanja odnose se isključivo na uzorak koji je ispitan.

Beograd, 09. 02. 2009.

Izveštaj izradio intun



Izveštaj odobrio za V.I. en Cu (Rukovodilac Odeljenja CIA *Ohja Geblionic* Rukovodilac Odeljenja GOM

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