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The comparison of the oil pollution results in the sea water by two different UVF apparatus

İki değişik UVF aletinde petrol kirliliği sonuçlarının mukayesesi

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Abstract

In this work was discussed the results of obtained by two different apparatus as Shimadzu RF 1501 and Jasco FP 6300. The measurements of oil pollution level in the sea waters were determined by using references of the Russian and Iraq crude oils and chrysene. It was found some differences between the results obtained by two apparatus. The error in the results of the references are in Russian crude oil between 01-4.4%, in Iraq crude oil 2% and in chrysene sample 5.8%. Based on these results it was suggested that the measurements must be made by the same apparatus.

Keywords: UVF, apparatus, Shimadzu, Jasco.

Introduction

The fluorescence spectroscopic method is a rapid and cheap screening technique and has excellent sensitivity in determining fluorescent compounds in pharmaceutical, biomedical and environmental samples such as sea water. Spectrofluorometry is based on the assumption that the fluorescence intensity in a sample is quantitatively related to its standard (Mzoughi et al. 2005). Fluorescence analysis is very sensitive for single aromatic compounds. Different numbers of fused aromatic rings exhibit their maximum emission of particular wavelength. Ultraviolet fluorescence (UVF) analyses are possible only the sample and standard have the same aromatic composition.

The fluorescence has a tendency for some molecules to absorb radiation in the ultraviolet or visible regions of the spectrum and then to emit radiations usually at longer wavelengths. In other word fluorescence term is used to describe the emission which accompanies a transition from a higher to a lower electronic state (Hamilton 1960). The molecule is excited (ex) into a state of higher energy and the measurement is made from the emission (em) produced.

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The equation given indicates that the intensity of fluorescence depends upon on the exciting light (Hamilton 1960). The fluorescence intensity should be directly proportional of the

fluorescing species. The limit of detection for many compounds assuming carefully purified solvents and reagents is frequently in the vicinity of from 0.1 to 0.001 μg/ml.

The sensitivity of instrument is an important point. In general, measurements were made on the same instrument (LAW 1981). It is recommended for the measurement, the wavelength and for the intensity (ex/em) must be determined for the specimens substances before the analysis (Gezgin 2005). The errors are more serious if the compound analyzed is not pure.

There is not any direct comparison of the results obtained from different instruments. In this work the results of two different instruments were compared.

Material and Methods

Sample: Sea water collected from Golden Horn (Stations B1, B2, B3) and Sea of Marmara (Stations M8, M11).

References: Seven Russian crude oils imported by TÜPRAŞ İzmit Refinery, three samples from Botaş (Iraq oil) and chrysene (Merck).

Stock solutions were prepared as 100 μg in 100 ml hexane.

Standard curve: The concentrations of the references were prepared, seven Russian crude oil standards (0.25, 0.50, 1.00 μg/ml), three Iraq oils (0.25, 0.50, 1.00, 2.00 μg/ml) and chrysene (0.05, 0.10, 0.15, 0.20, 0.25 μg/ml).

Apparatus: Shimadzu 1501 UVF and Jasco FP 6300 UVF. em. WL: 360.0 nm, ex. WL: 310.0 nm, Response: 0.02 sec. ex. Band width: 10 nm, em. Band width: 10 nm, sensitivity: medium.

Solvent and chemical compounds were used Merck (Darmstadt Germany Product).

Extraction of oil from sea water (Law 1981, UNESCO 1984, Kelly et al. 2005, Mzoughi et al. 2005): 800 ml sea sample was extracted three times with 20 ml dichloromethane (DCM), the extracts were collected and dried over anhydrous sodium sulfate, filtered and distilled. The residue was taken with hexane and the volume was adjusted to 10 ml and their intensity was measured by two apparatus at 310/360 nm (ex/em).

Results

Standard curves equations and their mean equations of seven Russian and three Iraq crude oil samples and chrysene are shown in Table 1.

Table 1. The equations and mean equations of references and through two apparatus

Russian oils	Shimadzu RF1501	Jasco FP 6300
REB 07.09.2006	y=847.54xC–4.2597, R^2= 0.9994	y=307.9699xC–9.5035 R^2= 0.999999
REB 14.11.2006	y=701.7457xC–75.7550, R^2= 0.99969	y=241.0477xC–24.1976, R^2= 0.99959
SIB 05.09.2006	y=874.9xC–11.559, R^2= 0.9997	y=311.8302xC–5.5033 R^2= 0.999937
SEB 31.08.2006	y=875.08xC–7.4635, R^2= 1.0000	y=307.0875xC–2.1384, R^2= 1.000000
SEB 16.10.2006	y=817.46xC–14.831, R^2= 1.0000	y=282.8989xC–6.6517, R^2= 0.999892
SEB 11.07.2006	y=829.78xC–16.864, R^2= 0.9997	y=282.2850xC–7.6774, R^2= 0.999983
REB 23.11.2006	y=816.37xC–19.073, R^2= 0.9951	y=296.7644xC–12.7224, R^2= 0.995742
Mean equation	**y=814.9052xC–10.3590, R^2= 0.999691**	**y=289.9834xC–1.8480, R^2= 0.999983**
Iraq crude oil		
I	y=432.0710xC–6.6883, R^2= 0.999972	y=277.8562xC–2.1930, R^2= 0.999995
II	y=457.7876xC–10.1008, R^2= 0.999424	y=288.8272xC–0.1118, R^2= 0.999900
III	y=463.5857xC–10.5891, R^2= 0.999881	y=282.4458xC–3.1270 R^2= 0.999881
Mean equation	**y=427.5005xC–2.3783, R^2= 0.99919**	**y=283.0430–1.8106, R^2= 0.99994**
Chrysene		
I	y=2141.06xC–6.0930, R^2= 0.998054	y=1288.8660xC–3.0317, R^2= 0.99947
II	y=2133.56xC–2.714, R^2= 0.9985	y=1279.720xC–1.9276, R^2= 0.99947
III	y=2127.56xC–1.834, R^2= 0.9986	y=1202.3919xC–3.7827 R^2= 0.99969
Mean equation	**y=2134.0595xC–3.5469, R^2= 0.99915**	**y=1256.6560xC–0.3928, R^2= 0.9998**

The analyses results of the sea water

The comparison of the results through Russian crude oil obtained from Shimadzu RF 1501 and Jasco FP 6300 spectrophotometer in sea water samples are shown in Table 2.

Table 2. The results of the sea water samples by two apparatus through Russian crude oil (μg/L)

Samples	Apparatus		Difference	Error%
	Shimadzu	Jasco		
Golden Horn B1	543.06	542.07	0.99	0.1
Golden Horn B2	86.81	82.96	3.85	4.4
Golden Horn B3	76.64	77.03	0.39	0.5
M11	207.69	210.52	2.83	1.3

The comparison of the results obtained from sea water samples by ıraq crude oil using two apparatus are shown in Table 3.

Table 3. The results of the sea water samples by two apparatus through Iraq crude oil (μg/L)

Samples	Apparatus		Difference	Error%
	Shimadzu	Jasco		
M8 10 m	21.21	20.65	0.44	2

The results obtained through chrysene references (0.12 μg/ml) are as follows:

Shimadzu RF 1501	0.120 µg/ml
Jasco FP 6300	0.113 µg/ml

The difference between the results for the chrysene sample measured by two apparatus is 0.007 µg/ml and error is 5.83%.

Conclusion

It was found that some differences on the results obtained by two different UVF apparatus. The error in the results of the references are in Russian crude oil between 01-4.4%, in Iraq crude oil 2% and in chrysene sample 5.8%. These errors are based on the intensity of the compounds, plotting the standard curves, crude oil types, and concentration of the samples (Mazoughi et al. 2005). International limit of standard error for quantitative resullts is 10%. The errors calculated in this work are not serious from the quantitative point. In spite of these results it is better to use the same apparatus for the determination of aromatic hydrocarbons (Law 1981).

Özet

Bu çalışmada iki UVF aletinde örneklerin ölçümü sonunda alınan sonuçları tartışıldı. Örnek olarak, Haliç, Marmara deniz suyu ve krizen maddesi kullanıldı. Her iki alette yapılan ölçümler sonucunda deniz suyunda %0.1-4.4, krizen örneğinde ise %2 fark bulundu. Bu sonuçlar dikkate alınarak devamlı çalışmalarda ölçmelerin aynı UVF aletinde yapılması önerilmiştir.

References

Gezgin, T. (2005). Deniz Kirliliği analizi yöntemlerinde kullanılan aletler. In: Deniz Kirliliği (K.C.Güven, B. Öztürk Eds.) TUDAV Yayınları 21, Berka Ajans Ltd. Sti. Istanbul.

Hamilton, L.F., Simpson, S.G., Ellis, D.W. (1960). Calculations of Analytical Chemistry, Mc Graw-Hill Book Company New York.

Kelly, C.A., Law, R.J., Emerson, H.S. (2000). Methods for analysis for hydrocarbons and polycyclic aromatic hydrocarbons (PAH) in marine samples. Aquatic Environment protection Analytical Methods. N:12, CEFAS, Lowestoft.

Law, R.J. (1981). Hydrocarbon concentration in water and sediments from UK marine waters, determined by fluorescence spectroscopy. *Mar. Poll. Bull.* 12: 153-157.

Mzoughi, N., Dachraoui, M., Willeneuve, J.P. (2005). Evaluation of aromatic hydrocarbons by spectrofluorometry in marine sediments and biological matrix: what reference should be considered? *Comptes Rendus Chimie,* 8: 97-102.

UNESCO. (1984). Manual for monitoring oil and dissolved/dispersed hydrocarbons in marine waters and on beaches. Manuals and Guides No. 13, p.13.

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