EurAsian Journal of BioSciences
Eurasia J Biosci 13, 651-662 (2019)

Determination of environmental considerations for the use of dispersant species in different areas of the Caspian Sea

Alaleh Gholipour Peyvandi [1*]

[1] Department of Natural Resources and Environment, Science and Research Branch, Islamic Azad University, Tehran, IRAN

Abstract

The diversification of activities on the shores on the one hand and the conflict between operators or part programs on the other hand make the monitoring and optimal management of resources in the coastal areas of the country compulsory.

An example of coastal issues that requires continuous and integrated management can be mentioned in some cases, such as coastal environmental issues and preventing possible damage to beaches. Addressing or reducing these problems is a serious challenge for local governments and central governments that, if continued, their harmful effects could have irreparable effects and damages. Therefore, beaches should be managed in such a way that they can be exploited. Rationalize the resources and capacities available.

One of the important issues related to coastal waters and their pollution is pollution of oil, and it is presented in order to reduce this important and effective pollutant which one of them is chemical purification, or the use of dispersant oil spots (dispersants). In this research, discussion of various types of dispersants has been carried out, and tests for toxicity and efficacy testing as well as quantitative testing of these materials have been carried out.

In the efficacy study it was found that if dispersant is effective, a quaternary solution is created which causes the water to become cloudy, and the reference solution that is used is not transparent, and only the oil spots are visible inside the water column. In the quantitative determination test 4 standard mixtures which each represent the performance of these materials, namely 100% efficiency, 75%, 50% and 25%.

In the quantification test, four standard mixtures prepared, that each represent the performance of these materials, namely 100%, 75%, 50%, and 25%.

In addition, the treatment of oil with dispersants, due to increased concentration of dissolved oil in water, increases the effect of direct oil toxicity on plant and animal life. Also, the relationship between the efficacy of dispersant and the three viscosity, temperature and flow factors was investigated and it was concluded that the effectiveness of dispersant decreased with increasing viscosity; Some dispersants in higher temperatures and with lower salinity and other low temperature dispersants operate with higher salinity.

Keywords: dispersant, oil pollution, Lc50, toxicity, viscosity

Peyvandi AG (2019) Determination of environmental considerations for the use of dispersant species in different areas of the Caspian Sea. Eurasia J Biosci 13: 651-662.

INTRODUCTION

Today, there are several methods for dealing with marine oil pollution that are divided into two categories: physical or mechanical, and chemical. Depending on the purification objectives, the type of beach, the type of oil composition, the opportunity to clean and the climate conditions of one or a combination of different methods will be used.

The use of booms is used to encircle oil spills on the surface of the water - and skimmers - a means for collecting oil or water mixed with oil from sea level - Hand-picking, Sorbents - Materials in the form of fiber or strip plates to absorb oil from the surface of the water. Wash contaminated beaches with water, pollution-specific floating vessels (floaters used to clean up oil pollution), on-site combustion and the use of chemical compounds are the most common methods of coping with oil pollution of seas and coasts.

Wash contaminated beaches with water, pollution-specific floating vessels (floaters used to clean up oil pollution), on-site combustion and the use of chemical compounds are the most common methods of coping with oil pollution of seas and coasts.

Received: March 2019
Accepted: June 2019
Printed: July 2019

Although the use of dispersants (late 60's) in the early days of the 60's was simply not accepted, there were worries about their negative environmental impacts, but more research, in particular the activities of the Canadian company SL Roos) led to the use of dispersants as an appropriate means for dealing with oil accidents in seas. Of course, the use of these materials requires observance of the principles and rules that vary depending on oil pollution and its severity and environmental conditions.

The use of dispersants should be determined by comparing the potential damage to the marine environment from cleaned oil pollution, and the long-term and short-term effects both should be taken into consideration. In areas with high dilution capacity and high input water volume (such as open water), dispersants are preferred, in areas where the oil / dispersant mixture may remain in the area for a long time (such as small bays and swamps) Should be avoided as far as possible from the use of dispersants.

Since the Caspian Sea, as a closed lake, does not have the power to exchange water, and the presence of dispersants for a long time may damage the fauna and flora of the region, and even damage the environment and damage the environment, as well as the use of dispersants when necessary. Emergency care should be taken into account. Considering the fact that, there has not been a detailed study on the use of dispersants in the Caspian Sea, so it seems necessary to do this research.

In the present study, while reviewing the physical and chemical conditions of the Caspian coastlines, they describe the dispersants, their performance, their role in response to oil spills, the types of available dispersants, the effects, advantages and disadvantages of these materials, their use limitations, Guidance on how to use dispersants, how to test the efficacy and toxicity of these materials, their environmental and economic considerations, and the regional cooperation and cooperation protocol on combating oil pollution accidents will be addressed by the Convention for the Protection of the Caspian Sea.

The purpose of this research is to study the physical and chemical characteristics of other waters of the world similar to the Caspian Sea. Considering the special circumstances of this large lake, the choice of dispersant type according to the Caspian conditions and characteristics, which has the least harmful effect on vegetation and it, has the animal and at the same time it has the greatest potential for cleaning up oil spills.

In fact, the purpose of this report is to provide a balanced view of when dispensers are suitable for use and when they are inappropriate, with particular reference to their environmental concerns.

In a general classification, it is possible to classify oil spill cleanup methods in mechanical, biological and chemical methods. However, the use of chemical methods and environmental impacts requires special attention.

RESEARCH LITERATURE

Understanding the Status of the Caspian Sea Coast

Climate: The southern coast of the Caspian Sea is in the wetland. The average celestial precipitation in the southern part is between 400 and 1800 mm, decreasing from west to east. The average annual evaporation of sea water is 800 mm in the southern coast of the Caspian Sea, rising from west to east. The average annual temperature in this area is 17 ° C. Relative humidity on the southern coast is among 24% to 100%, with an average of 66% (National Document for the Development of Overheating of the Coastal Surveys, 2007).

The regime of winds varies in different parts of this sea. In the northern Caspian Sea, there are north-eastern and eastern winds in the summer, and in the cold season, the northern winds - northwest and west are flowing. The average wind speed during the year is between 3 and 7 meters per second. The strongest winds will be in the months of October to May (Bazr Afshan 1996).

Records in Iran

Hamidreza Rezay Allahi (1996) studied the effects of oil and chemical wastes on the marine environment. In this study, we describe the dangers of marine oil pollution and its related chemical and chemical pollution, as well as in response to this the question of whether dispersants are beneficial or harmful. It was concluded that in different experiments some dispersants were effective on some of the oils, which means that they removed a large proportion of the oil from the surface of the water.

On the other hand, direct use of dispersants for birds and mammals (or their habitats) is definitely harmful. Because dispersant destroys water repellent and ability of feather insolated and fur. As well as the impact of the use of dispensers on human health, they found that the material was harmful by direct contact with crew and observers for dispersant dispersion and could indirectly affect human health. The most obvious are the increased degradation of deep organisms and superficial.

Pantea Mashhadi (2005) in her research on the evaluation of the effects of genotoxic Persian Gulf oil and dispersants used with salmonella typhimorium, the genotoxic effects of Pars1, and Pars1 new dispersant formulation and Gamlon dispersants as scattering confirmed by the international organization, it was tested and then compared. In this study, the toxic properties of these materials are considered in accordance with Ames's instructions.

Ali Asghar Khalili (2005) in his research on the synthesis and evaluation of ethoxylated oxoacetyl sulfosuccinate in dispersant, while investigating the different dispersants chemistry and formulation, concluded that, depending on the crude oil, the autoxylate sulfosuccinate has the potential to function properly in dispersant formulation, in order to eliminate oil spills. In this research, the use and non-use of dispersant as well as the history of the use of these materials have been investigated.

Sima Nikbakht (2005) investigated the effects of dispersant toxicity on aquatic organisms, and the toxic effects of dispersants of pars1, pars 2, new Formation of Pars1 and Pars 2 in different concentrations alone and along with oil on organisms. The results showed that the spread of oil was more toxic than oil alone, and experiments showed that these materials are more toxic than the oil.

Records outside Iran

In this section, some examples of the work done in the world on the players are briefly reviewed:

Kenneth Lee, Paul Kepkay (2010)

Ultraviolet spectrofluometry results and flame analysis of gas chromatography showed that dispersants and mineral impurities alone or in combination increase the dispersion of oil in the water column. Laser measurements in spot dispersion showed that the presence of mineral minerals increased the concentration of total suspended particles from 4 to 10 μl L-1, while the presence of dispersants reduced the particle size from 50 to 10 μm. The observation by microscope showed that the presence of dispersants, minerals, or both, combined, increased the number of particles dispersed in water.

Joseph V. Mullin, Ken Trudel, Randy C. Belore (2009)

In experiments on the effects of dispersant in cold water, on a large scale with Alaska crude oil, and the corexit 9500 and corexit 9527 dispersants, the results showed that the corexit 9500 and corexit 9527 dispersants, 99% -85%, were affected by the dispersion of crude oil, which was weathered and tested at cold temperatures.

G. De Marco & R. R. Lessard (2010)

Extensive and acceptable studies are available to use dispersants that greatly impacts their impact on oil platforms and their benefits to a vast environmental network. The main reason for the importance of this subject is that the different products of the dispersants cause the toxicity of marine life to be reduced and cause the erosion of the oil. This ability proves extensive and difficult testing, field experiments, and applications of dispersants on real platforms. This paper shows the recent developments briefly on dispersants and provides an overview of the concepts of technology advancement.

Alun Lewis, Randy C. Belore (2010)

The use of dispersants devices on oil platforms in the Pacific is a bit discouraging. Due to the fact that mixed energies that cause immediate dispersion of oil are not enough. However, dispersants devices may be used when the sea is calm and when the sea is raging.

The tests of these platforms show that the primary mix of dispersants flows in stagnant and fresh water for 6 days, and whenever necessary, they are placed without a shield to break the waves. The results show that thicker surfaces that are exposed to calm waters completely emit dispersants within 6 days. The thinner platforms that are exposed to flammable waters will be emitted within 2 days. The lack of this disparity causes the dispersants to cause less oil erosion.

Oh Youn Kwon, Chang Kyu, Seung Won Jung (2012)

In order to investigate the effect of crude oil and dispersant in marine plankton ecosystems, analysis was performed on Mesocosm L-1000 over a 9-day period. Experiments were carried out for two different treatments, namely oil alone and oil with dispersant, and it was found that in oil with dispersant, a high concentration of total hydrocarbon (TPH) was found rapidly in the lower layer, and showed that TPH concentration had a significant negative relationship with Phytoplankton and zooplankton communities within 2 days.

The results showed that planktonic ecosystem was the first to see most damage by dispersant compared to the harmful effects of crude oil itself. Therefore, given the direct application of dispersant in natural environments, caution should be exercised, even if its use quickly causes to remove crude oil.

Karen Purnell, Robin J. Law, Helen Chapman (2007)

In order to better understand the use of dispersant, a survey was conducted on marine oil leakage during a 10-year period and changes were made between different regions and types of oil in particular. This paper provides data analysis and a wide range of dispersant usage policies. In this research, focusing on the effects of dispersant and monitoring of toxicity and environmental effects, the use of dispersant in low salinity water, planning Shows the answer and future research needs.

SL Ross Environmental Research Ottawa, ON (2010)

The purpose of this study is to use dispersants in fresh and salty waters to help decision makers when faced with these conditions. In the past, the use of chemical dispersants in response to oil spills in the United States was primarily limited to offshore waters where high-water salinity was high. Today, the use of converted dispersants that are most accepted are found in places close to the beach where fresh water or lips are salty and also in infected ice waters where molten water can significantly reduce the salinity levels.

Most formulated dispersants effect in areas with relatively high-water salinity, and when they are applied in sweet waters or salty lips, they lose their effectiveness.

Mark F. Kirby, Robin J. Law, Karen Purnell (2010)

In order to better understand the use of dispersants in seas and oil platforms over the past ten years (1995-2005), it is better to consider the differences between different regions. Existing views and analyzes indicate that there are different policies for using dispersants. The articles also deal with the issue of accessing dispersants, their use and introduction over the past ten years.

Per S Daling & Ivar Singsaas & Mark Reed (2010)

In Norway, mechanical recycling on oil platforms is preferable to old techniques over the past decades. Recently, the Norwegian Pollution Control Company (SFT) has paid special attention to the use of dispersants on oil platforms. The responsibility for these programs and decisions regarding the use or non-use of dispersants in the oil industry and investment in this category is related to SFT approval. According to the “internal control” law, the agents should pay attention to the regulations. There is a new law for the use of dispersants in Norway that there should be feasible plans in the form of acceptable documentation for the construction of refineries, oil stations and offshore facilities. This change in the use of dispersants in Norway is the result of the scientific advancement of the recent use of dispersant.

G. A. Ward, C. H. Lane & P. A. Schuler (2005)

TROPICS Tests - Tropical oil pollution research was investigated in coastal systems. The experiments consisted of untreated crude deposits of Prudhoe Bay and dispersants in two separate locations, covered by shore near Mangrove, offshore and coral systems in 1984 .The two sites were monitored after 30 days, 3 months, 2, 6, 10, 17, 18 and 20 years. Oil caused mortality in short periods of time in animals without spinal cord, weeds, and corals on both oil and non-oil sites. In the untreated site, the mortality of mangroves was seen in the first period of time. After 20 years, there is still oil on this site and the population of mangroves has fallen. On the dispersant oil site, there is no effect or oil after 20 years. Consequently, the use of dispersants in these environments has environmental benefits (Baca et al. 2005).

Brekne, T. M., S. Holmemo & G. M. Skeie (2003)

New research on offshore pollution in Norway was investigated. As part of this research, helicopter-based dispersant systems were deployed away from the offshore. The entire system will be sent from the acted offshore platform (Brekne et al. 2003).

H. Takada, K. Toyoda, A. Yoshida & M. Nishimura (2003)

The PAHs were investigated with dispersant and non-dispersant in 500 liters reservoirs of water with sea water. The 38 PAH (aromatic hydrocarbon) was analyzed. Low molecular weight hydrocarbons (less than 3 rings) disappeared rapidly after 2 days, hydrocarbons with a high molecular weight (more than 4 rings) remained in the water column for a long time for about 9 days.

A significant portion (10-49%) of PAH with high molecular weight at the end is dissolved and trapped in sediment trap. In addition to chemical dispersants, aromatic hydrocarbons (PAHs) are dissolved quickly, but some of them are strengthened in the water column. Dispersants will have a 6-fold enrichment factor in water column. It seems that the aromatic hydrocarbons increased in water column and gradually decomposes, therefore, high-hydrocarbon concentrations are observed in dispersant-treated reservoirs during the course of the experiment. Hence, dispersants reduce heavy sediment hydrocarbons, and fall into the water column.

Belore, R., A. Lewis, A. Guarino & J. Mullin (2008)

The dispersant’s effectiveness test on crude oil on the continental shelf of the United States was carried out in two small reservoirs and in OHMSETT, and the viscosity crude dispersion ability was studied.

It concludes that oils with less than 6500 cP is sufficiently dispersible, and oils with a viscosity of more than 33000 cP cannot be dispersed. Experiments on emulsions showed that the effectiveness of about 10-40% with corexit 9527 is slightly more than the effectiveness of corexit 9500 (Belore et al. 2008).

Fingas, M., B. Fieldhouse & Z. Wang (2006)

Alaska’s crude oil dispersion rate has been measured at different temperatures and salinity. The findings of these studies have shown that there is a mutual interaction between salinity and the effectiveness of dispersants on North Alaska crude oil. Temperature variation and salinity are also interrelated (Fingas et al. 2006).

G. C. Okpokwasili, L. O. Odokuma (2003)

Biochemical Oxygen Demonstration (BOD) and biological analysis of river water for dispersion of oil in 3 concentrations of sodium chloride (0, 20 and 40 g / L) were performed at ambient temperature. Surfactant concentration was also evaluated by infrared spectroscopy. The results showed that the used dispersed microbial degradation decreased with increasing salt concentration (Okpokwasili and Odokuma 2003).

Fuller, C. & J. S. Bonner (2001)

Comparative toxicity studies were performed using marine luminescent-bacteria (Vibrio fischeri), two marine vertebrates (Menidia beryllina and Cyprinodon variegatus), and an experimental in-vertebrate species.

Except bacteria, the others were exposed to 96 hours, which is a standard period. The experiment was conducted only for the disperser, in a short time, for two modes of water-substituted particle (oil) and, dispersed oil done chemically. Observations showed lower toxicity in all cases. The corexit 9500 dispersant showed 73LC50 to 500 mg/L. Water - substituted particle (oil) showed the LC50 from 0.7 to 83 mg / L, and chemical dispersed oil, LC50 from 0.6 to 60 mg / L.

RESEARCH METHOD

Introduction of Dispersant and their Performance

Dispersants are chemical agents that are soluble in water and partly soluble in oil.

These compounds change the fate of oil pollution by facilitating the breakdown of oil spills into fine droplets.

The fine oil droplets produced by the dispersant function are suspended and dispersed in the mass water. Therefore, oil penetration increases into the seawater column. The dispersed oil particles in the water column decompose faster than the oil levels and create conditions that threaten the environment less than (Mir Hosseini and Nezami 2010).

How do Dispensers Work?

Basically, oil and water are not mixed easily. Spreading oil is floating in a calm condition.

The process of waves combination can combine water and oil in two ways:

Natural dispersal: In this case, the waves will cause the oil spill to turn into a tiny oil droplet that is temporarily suspended in water. Most of these oil droplets are large enough to float and return to the surface quickly. However, a small portion of the oil is a form of small droplets and their thrust is almost neutral.

These very small oil droplets will remain dispersed in water and will remain almost infinite, and will be repeatedly retreated by the action of waves under pressure.

Water-in-oil emulsion: The action of mixing waves can also cause water-to-oil droplets in the form of water-oil emulsions, often expressed as chocolate mousse.

The emulsion has a much higher viscosity than the oil. The emulsion volume can ultimately increase up to 4 times the amount of oil spilled, since the emulsion volume typically contain up to 75% of water.

While emulsions are concentrated and continuous, and can seriously create coastal erosion problems, dispersant oil can also be diluted with sea water and reach a small concentration and can have an impact on marine life.

The propulsion force for both of these cases, natural dispersal and water emulsion in oil, is the energy of the wave. Crude oil with low viscosity disperses significantly and naturally in rough seas, but violent seas may also cause rapid emulsification.

Increasing the viscosity will be cause to evaporate the volatile components in the oil and resist the effects of waves in converting oil into small droplets. This increase in viscosity also enhances the formation of emulsions, because water droplets are depleted more slowly than oil with higher viscosity.

Sustainable Emulsion is Formed when Asphalt is Deposited from the Oil

Asphaltenes are heavy and bituminous materials that are recently present in some ratios of crude oil. They are not real solutions, but in microscopic suspension, they are used by other materials in oil.

The relative percentage of natural dispersion and emulsion depends on the sea conditions and oil composition. The poured crude oil is lighter and at first naturally tends to disperse. But the amount of dispersion is largely reduced to emulsify. Those oils that are weathered and their asphaltic materials are high, preferentially, they tend to be emulsified.

Spreading Methods of Dispecants

- Spray by ship
- Spray through the plane (Ahmadpour and the Faqih 2009)

Methods of Using Dispersant Materials

The best way to use this material is to spray at least as much time as possible on oil spills (in physical contact). At the time of spraying, oil spills are split into small pieces and driven into the front. The best use of this material should start from the edge of the oil spill and continue towards the center of contamination.

If oil spills are in the form of fluttered and threaded filaments, we will not have good dispersant contact with oil pollution and will prevent dispersant dispersion to water column.

Spray dispersant with floating than air methods has a lower operating speed.

Air methods cover regions with more areas.

If oil spots are dispersed and distant, it is advisable to use aerial techniques.

The concentration of these materials should not be less than 10%, because their effectiveness is reduced. The use of dispersant materials should be carried out under calm conditions of the sea, and the storm and wind conditions will spoil these materials and prevent direct impact on oil spills.

The particle size of the dispersant is of particular importance and should be between 400 to 700 µm. If the particle size is too large, the dispersant material can easily pass through the oil spill into the water column, and if it is too small, it will be dispersed by the air and the wind.

Generally, the dispersant material spray should be made in the direction of wind blowing, the wind

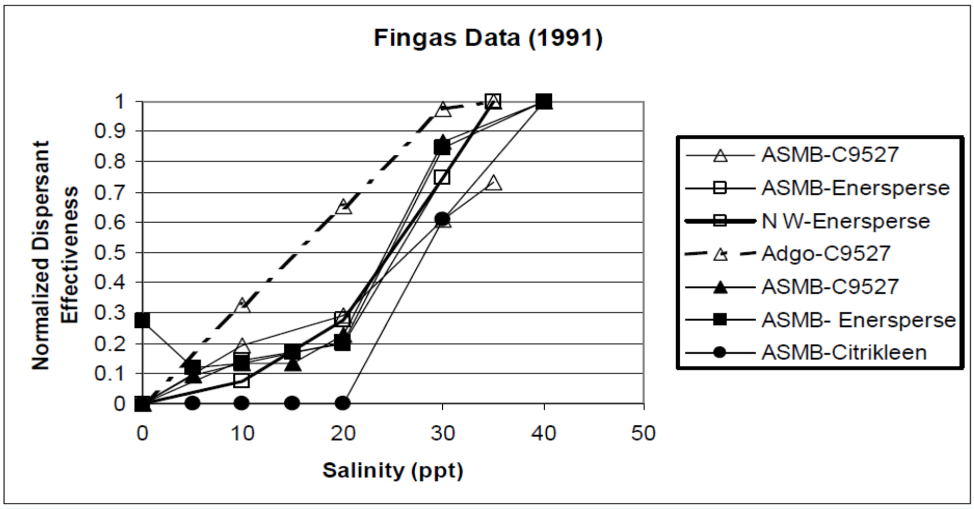

Fig. 1. The results of the normal dispersant efficacy by Fingas et al. (SL Roos 2010)

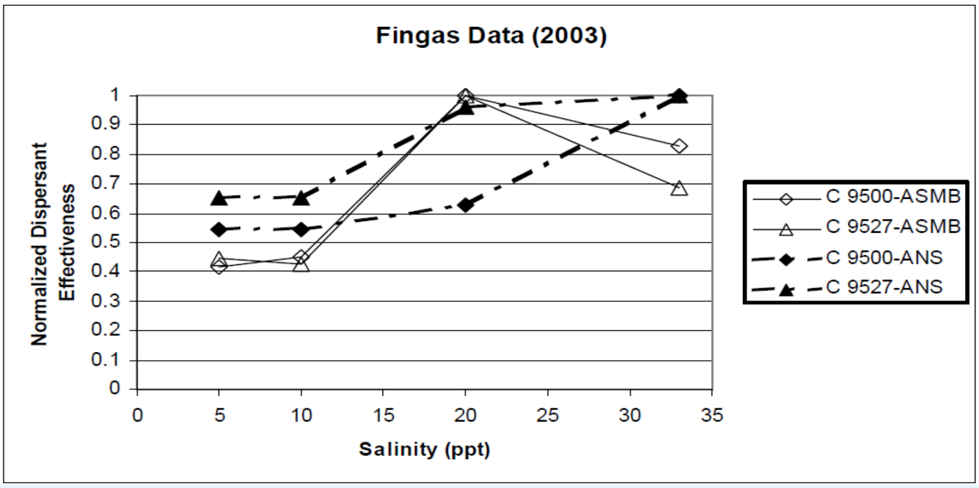

Fig. 2. The results of the normal dispensant efficacy by Fingas et al. (SL Roos 2010)

conditions should be mild, about 11 to 21 nautical miles, and the length of the waves should be about 1 to 2 m.

When using dispersant materials with airplanes, the amount of thickness of oil pollution is very important. Therefore, the dispersant volume consumed should be 5 to 10 % of the volume of contamination. If the thickness of the oil layer is between 0.04 to 0.3 μm, then dispersant cannot be used to remove them.

If the air method is used to spray dispersers, the airplane's height from the sea level should be about 50 to 100 feet, and as mentioned earlier, there is no need to dilute the dispersant materials and should be applied purely.

Preparation of Map the Oil Pollution of the Area by Gps

Tests of toxicity and efficacy testing as well as quantitative testing of these materials have been carried out.

In the test, the quantification of 4 standard mixtures, each of which represents the performance of these materials, is 100%, 75%, 50% and 25%.

FINDINGS

The most commonly used dispersants intended for use in the United States are corexit 9500 and corexit 9527, and much research on dispersant performance, including these two disperses. For these reasons, the normal test results for these two dispersants are discussed in the first stage.

In **Fig. 1**, the results of the corexit 9527 are plotted using a triangular symbol.

In these experiments, the maximum effectiveness achieved for corexit9527 at 35ppt or higher is for all types of oil; in 20ppt of saline water for all, in particular, oil Adgo drops performance sharply decreased. The Enersperse 700 dispersant exhibited a similar trend, and Citrikleen's effectiveness at 20 ppt was reduced to zero.

The dark lines in **Fig. 2** refer to North Alaska Crude Oil combination (ANS), thinner lines are the Alberta Sweet Alcoholic Beverages (ASMB). In this case, both the corexit 9527 (triangular icon) and the corexit 9500 (diamond icon) dispersant showed maximum efficiencies of 20 to 33 ppm of water salinity for the two

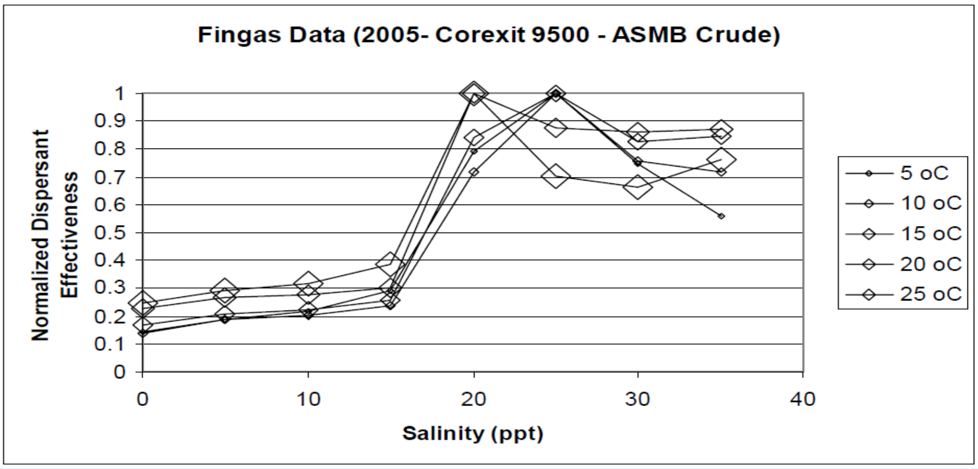

Fig. 3. The results of the normal dispersant efficency by Fingas et al. (SL Roos 2010)

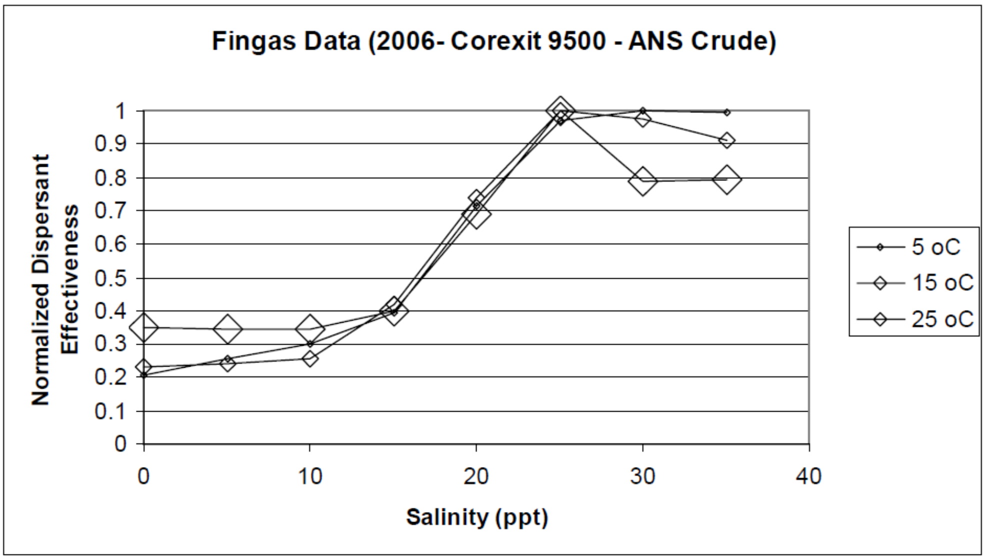

Fig. 4. The results of the normal dispersant effeciency by Fingas et al. (SL Roos 2010)

oils, and effectiveness in all tests when the salinity was less than 20 ppt, is decreasing.

In completed experiments on ASMB crude oil, in 2005 (**Fig. 3**), the corexit 9500 achieves maximum efficiency at 20 ppt salinity and exhibits a sharp decline in performance at lower salinity.

The results of the corexit 9500 on ANS (**Fig. 4**) show maximum efficiencies in 25 ppt. water salinity for this oil shows a significant reduction in effectiveness (decrease of 30%) when salinity is reduced to 20 ppt.

Belk et al. (1989) tested four formulated dispersants for marine conditions on two Warren Spring oil and Prudhoe Bay crude oil at two temperatures of 20˚C and 10˚C.

Dispersants were not identified by their names in these experiments. **Figs. 5** and **6** show the results for sea formulation dispersants at 20˚C and 10˚C, respectively.

The bold lines on these charts show the results for the Prudhoe Bay crude oil and the lower volumes for the Warren Spring oil. The process of effectiveness for both temperatures is very similar; therefore, the following discussion is generalized to both sets of these results. From dispersants tested on the sea, dispersant C shows the best results in a wide range of water salinity with efficiency over 40% to 60%.

Many tested marine dispersants have maximized the efficiency of water in 35 ppt on both types of oil and the effectiveness reduction of 10 to 20% of the maximum salinity is under zero.

Dispersants A and B achieved the best results for Prudhoe Bay Crude at around 20 ppt and the effectiveness in both cases of high and low salinity decreased. These two types of dispersants are more effective in lower salinity than those dispersants, but are less effective in high salintary (SL ROSS Environmental Research 2010).

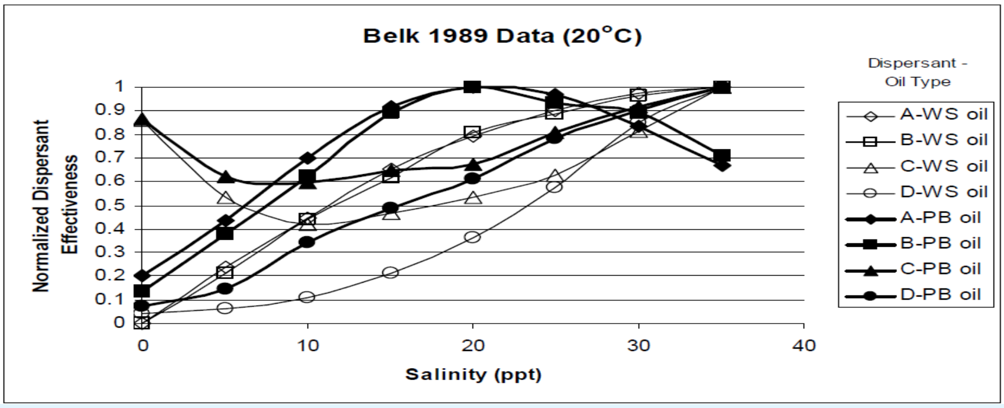

Fig. 5. The results of the normal dispersants efficiency for the dispersants of the sea at 20 ° C, by Byford et al. (SL Roos 2010)

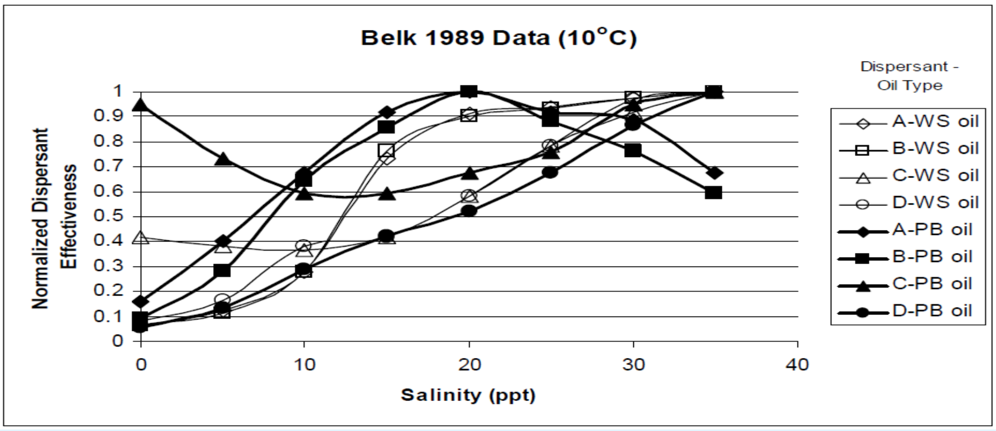

Fig. 6. The results of the dispersants efficiency for the dispersants of the sea at 10 ° C, by Byford et al. (SL Roos 2010)

Policies and Guidelines for Using Dispersant in Salt Lips Water

(Caspian Sea "Azerbaijan Sector")

The Caspian Sea is one of the largest closed waters in the world and is classified at various times as the largest lake in the world or a complete sea. The Danube River has the largest entrance to this lake and does not have any outlet. Water salinity in the Caspian oil development areas is 7 ppt, and in other areas, salinity is about 30 to 35 ppt.

The composition and salinity of the water in the Caspian Sea are very different from the waters of other oceans, which are the basis of the most used formulated dispersant products.

✓ Simple laboratory tests can evaluate the relative efficiency and toxicity of different dispersants under different laboratory conditions for a wide variety of oil types.

✓ Dispersants can be a major answer option in some areas. Various environmental arguments exist in favor of using dispersant as a major response option in areas where mixing and dilution can quickly reduce dispersed oil concentrations at levels that pose a threat to aquatic organisms.

This is usually occurs in areas where the depth of water is more than 10 m and the distance from the coast is more than 5 km.

✓ Dispersants should be considered as a sub-option in other areas (areas less than 5 km from the coast and at a depth of less than 10 m). Here, the net environmental benefit is worth the value of the coastal environmental resources generated by each leak Wildlife, marine plants, coastal habitats and coastal marshes) will be threatened, and the potential for oil spill in the region or the redistribution of oil will depend on other areas.

A more detailed assessment and details show that oil distribution will have a generous environmental benefit, even if such an action may have a short-term increase in aquatic life at shallow coastal areas (SL Ross, 2010).

The Relationship between the Effectiveness of Dispersant and Viscosity

The oils with a viscosity of between 5,000 to 10,000 centipoises are hardly dispersed, and the higher than 10,000 cP usually do not dispersed.

The relationship between the dispersants effectiveness and the viscosity of oil for a range of oils and emulsions is: (Density × Cst = centipoise) (**Fig. 7**)

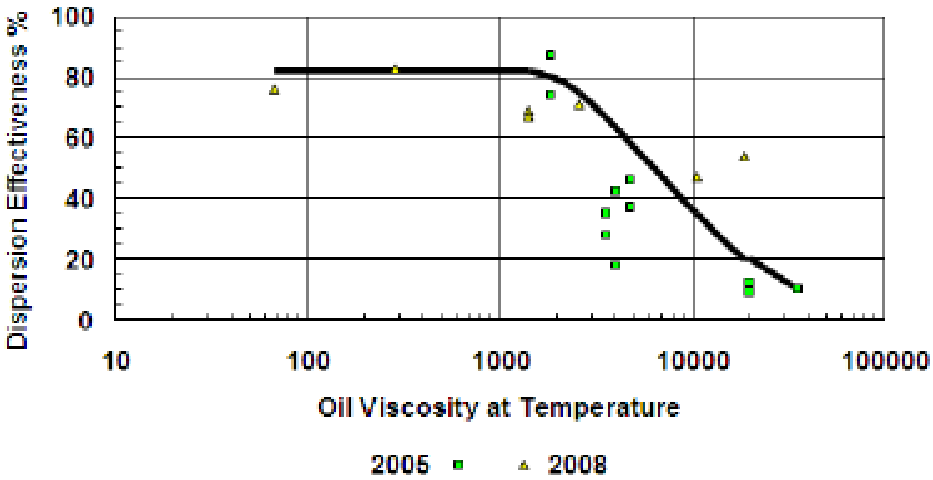

Fig. 7. Effectiveness of Dispersant against oil viscosity (ITOPF 2011)

RESULTS

In the present research, discussion of various types of dispersants has been carried out, and tests for toxicity and efficiency as well as quantitative testing of these materials have been carried out. In the efficiency test seen that, if the dispersant is effective, an opaque solution was created which makes the color of the water to become opaque, and the reference solution that the dispersant is used is more transparent and only the oil spots appear inside the water column.

In the determination of quantification test, four standard mixtures prepared that each represent the efficiency of these materials, namely 100%, 75%, 50%, and 25%. Furthermore in oil treatment with dispersants, due to increased concentration of dissolved oil in water, the increase in the effect of direct oil toxicity on plant and animal life is caused. Also, the relationship between the effectiveness of dispersant and the three viscosity, temperature and salinity factors was investigated and it was concluded that the efficacy of dispersant decreased with increasing viscosity; some dispersants were found in water with a higher temperature and less salinity and some other dispersants at a lower temperature effect with higher salinity.

SUGGESTIONS

- Dispersant should be used when oil spills are a threat to coastal areas and there is no mechanical retrieval capability.
- For the use of dispersant material it must be considered that wave energy, is sufficient to break the smooth surface and facilitated the combination of oil droplets in the water column.
- Be careful that dispersant has the catalyst mode to accelerate the chemical reaction, and the nature works better against broken spots.
- Oil should be of a known type and have the capability of dispersion.
- There must be sufficient potential for rapid dilution of dispersed oil.
- And of course spraying solution has done, and dispersant will not be applied directly to birds and mammals.

Large stagnant oil spills, especially light petty oil spills, must be left to decompose naturally unless they pose a risk to marine environments and sensitive ecosystems (Tidal areas, mangrove forests, harbors, and laying sites).

- We make a brief EIA every time we use dispersants.

The use of dispersants in the coral coasts of the islands, as well as shrimp and fish shores, is very inaccurate.

- It should always be borne in mind that dispersants should be applied in areas of high depth to ensure good dispersion of oil. Otherwise, in areas with low depth, for example, less than 20 m, use of dispersants is more risky.
- The maximum thickness that oil can have for dispersant to work well is 6 mm. In some cases with a higher thickness, it is necessary to first use mechanical methods for cleaning.
- If the flow of water is toward the shore, the use of dispersants should be avoided.
- Dispersants should not be used in cases where oil spills are heavy and cannot be spread.
- The oil should not be used when the oil comes in the form of thin, luminous layers.

REFERENCES

Ahmadpour F (2009) Basic measures to control oil pollution at sea, General Office of Environmental Protection of Bushehr Province.

Baca B, Ward GA, Lane CH, Schuler PA (2005) Net Environmental Benefit Analysis (NEBA) of Dispersed Oil on Nearshore Tropical Ecosystems Derived From the 20 Year ‘Tropic’ Field Study. In Proceedings of the 2005, International Oil Spill Conference, American Petroleum Institute, Washington, D.C.: 453-456. https://doi.org/10.7901/2169-3358-2005-1-453

Bazrafshan AA (1995-1994) Physicochemical Parameters and Oil Pollution in the Southeast of the Caspian Sea, Islamic Azad University. Master’s Thesis. Department of Science and Technology, Marine Branch.

Belore R, Lewis A, Guarino A, Mullin J (2008) Dispersant Effectiveness Testing on Viscous, U.S. Outer Continental Shelf Crude Oils and Water-In-Oil Emulsions at Ohmsett. In Proceedings of the 2008 International Oil Spill Conference, American Petroleum Institute, Washington, D.C.: 823-828. https://doi.org/10.7901/2169-3358-2008-1-823

Belore R, Ross S (2000) Laboratory Study to Compare the Effectiveness of Chemical Dispersants When Applied Dilute Versus Neat. In Proceedings of the Twenty-third Arctic Marine Oilspill Program Technical Seminar, Environment Canada, Ottawa, ON: 733-748.

Brekne TM, Holmemo S, Skeie GM (2003) Optimizing Offshore Combat of Oil Spills and Development of New, Booms and Helicopter Based Application of Dispersants. In Proceedings of the 2003 International Oil Spill, Conference, American Petroleum Institute, Washington, D.C., 6 p. https://doi.org/10.7901/2169-3358-2003-1-1279

Canevari GP, Calcavecchio P, Lessard RR, Becker KW, Fiocco RJ (2001) Key Parameters Affecting the Dispersion of Viscous Oil. In Proceedings of the 2001 International Oil Spill Conference, American Petroleum, Institute, Washington, DC: 479-483. https://doi.org/10.7901/2169-3358-2001-1-479

Chemie Kaarten (1989) Gegevens Over Veilig Werken met Chemicalien, pp. 103,677,845,910,911.

de Boer J (1993) Shetland Islands,Verslag Vande Olieramp met de “Braer.”

Doerffer JW (1992) Oil Spill Response in the Marine Environmental. Pergamon Press, pp. 23-47,54,58-59,97-104.

Effimoff I (2000) The Oil and gas resource base of the Caspian region. Journal of Petroleum Science and Engineering, 28: 157-159. https://doi.org/10.1016/S0920-4105(00)00075-9

Elahi R, Reza H (1995) Oil and Chemical Effects on the Marine Environment. Master’s Thesis. Islamic Azad University Marine Science and Technology Branch.

Fingas M, Fieldhouse B, Wang Z (2006) The Effectiveness of Oil Spill Dispersants on Alaskan North Slope Crude Oils Under Various Temperature and Salinity Regimes. In Proceedings of the Twenty-Ninth Arctic Marine Oilspill, Program Technical Seminar, Environment Canada, Ottawa: 821-826.

Fingas M, Fieldhouse B, Wang Z, Sigouin L, Landriault M, Mullin JV (1999) Analytical Procedures for Dispersant Effectiveness Testing. In Proceedings of the Twenty-second Arctic Marine Oilspill Program Technical Seminar, Environment Canada, Ottawa, ON: 231-241.

Fingas M, Spill Science, Edmonton, Alberta (1997-2008) A Review of Literature Related to Oil Spill Dispersants, Anchorage, Alaska. https://doi.org/10.7901/2169-3358-2008-1-661

Fingas MF, Fieldhouse B, Sigouin L, Wang Z, Mullin JV (2001) Dispersant Effectiveness Testing: Laboratory Studies of Fresh and Weathered Oils. In Proceedings of the Twenty-fourth Arctic Marine Oilspill Program Technical, Seminar, Environment Canada, Ottawa, ON: 551-566.

Fiocco RJ, Daling PS, DeMarco G, Lessard RR (1999) Advancing Laboratory/Field Dispersant Effectiveness Testing. In Proceedings of the 1999 International Oil Spill Conference, American Petroleum Institute, Washington, DC: 177-185.

French-McCay DP, Payne JR (2001) Model of Oil Fate and Water Concentrations With and Without Application of Dispersants. In Proceedings of the Twenty-fourth Arctic Marine Oilspill Program Technical Seminar, Environment, Canada, Ottawa, ON: 611-645.

Fuller C, Bonner JS (2001) Comparative Toxicity of Oil, Dispersant and Dispersed Oil to Texas Marine Species”, in Proceedings of the 2001 International Oil Spill Conference, American Petroleum Institute, Washington, DC: 1243-1241. https://doi.org/10.7901/2169-3358-2001-2-1243

Geosciences & Mining Monthly (2010) No. 58, Features of the Caspian Sea and its surface level fluctuations, Geological Survey of Iran.

Geraci JR, ST. Aubin Dj (1990) Sea mammals and oil, Confronting the risks. Academic Press, Inc., pp. 1-6,9-27,103-125. https://doi.org/10.1016/B978-0-12-280600-1.50009-X

Guyomarch J, Merlin F-X, Colin S (1999) Study of the Feasibility of Chemical Dispersion of Viscous Oils and Water-in-Oil Emulsions. In Proceedings of the Twenty-second Arctic Marine Oilspill Program Technical Seminar, Environment Canada, Ottawa, ON: 219-230.

IMO (International Maritime Organization) (1988) Manual on oil pollution, London.

Instructions on the use of dispersants in oil pollution operations at sea, Ports and Maritime Organization

IPIECA REPORT SERIES (2001) Dispersants and Their Role in oil Spill Response, volume five, London.

ITOPF (2011) Use of Dispersants ToTreat Oil Spill, London.

Kaplin P (1995) Caspian Sea Environmental Situation in the Condition of Water Level Raises. J. Water and development, 3(1): 123-150.

Karpinsky MG (1992) Aspects of the Caspian Sea benthic ecosystem. Marine Pollution Bulletin, 24: 384-389. https://doi.org/10.1016/0025-326X(92)90498-U

Law RJ, Klungsoyr J (2000) The analysis of Polycyclic aromatic hydrocarbons in marine samples. International Journal of Environment and Pollution, 13: 262-283. https://doi.org/10.1504/IJEP.2000.002319

Lewis A, Crosbie A, Davies L, Lunel T (1998) Large Scale Field Experiments Into Oil Weathering at Sea and Aerial, Application of Dispersants. In Proceedings of the Twenty-first Arctic Marine Oilspill Program Technical Seminar, Environment Canada, Ottawa, ON: 319-344.

Lin Q, Mendelssohn IA (2005) Dispersants as Countermeasures in Nearshore Oil Spills for Coastal Habitat Protection. In Proceedings of the 2005 International Oil Spill Conference, American Petroleum Institute, Washington, D.C.: 447-451. https://doi.org/10.7901/2169-3358-2005-1-447

Mirhosseini SM, Nezami B (2010) How to use dispersants to deal with oil pollution with regard to the fragile Persian Gulf ecosystem. Ph.D. seminar. Azad University of Science and Research Branch, Tehran.

Mostaghimi B (1384) Conservation of the Caspian Sea, Diplomatic solutions, Ministry of Foreign Affairs publication, First edition.

Najdaki A (2006) International Oil Pollution Regimes Regulation and its Application to Prevent Oil Pollution in Persian Gulf and Oman Sea. Master's Thesis. Islamic Azad University, Science and Research Branch of Tehran.

National Document for the Development of Cross-border Reconstruction of the Coast of the Country, 2007, Ports and Maritime Organization.

Nick Thorp (2011) Oil Dispersant Glossary.

NOAA (National Oceanic and Atmospheric Administration), CRRC (Coastal Response Research Center) (March 2012) The Future of Dispersant Use in oil Spill Response Initiative, U.S.Department of Commerce.

Okpokwasili GC, Odokuma LO (2003) Effect of Salinity on biodegradation of oil spill dispersants. Department of Microbiology, University of Port Harcourt.

Payne JR, Allen AA (2005) Use of Natural Oil Seeps For Evaluation of Dispersant Application and Monitoring Techniques. In Proceedings of the 2005 International Oil Spill Conference, American Petroleum Institute, Washington, D.C.: 241-245. https://doi.org/10.7901/2169-3358-2005-1-241

Policy and Guideline for Use of Oil Spill Dispersant (OSD) in Indian Waters.

Shetland Times (02.04.93) Interim rapport on seawater monitoring, p.12,15.

Simulation of Oil Spill at Sea (1995) Environmental Protection Agency.

SL ROSS Environmental Research (2010) Literature Review of Chemical Oil Spill Dispersants and Herders in Fresh and Brackish Waters, Ottawa, ON.

Steen A, Findlay A (2008) Frequency of Dispersant Use Worldwide. In Proceedings of the 2008 International Oil, Spill Conference. American Petroleum Institute, Washington, D.C.: 645-649. https://doi.org/10.7901/2169-3358-2008-1-645

Swannell RPJ, Daniel F (1999) Effect of Dispersants on Oil Biodegradation Under Simulated Marine Conditions. In Proceedings of the 1999 International Oil Spill Conference, American Petroleum Institute, Washington, DC: 169-176. https://doi.org/10.7901/2169-3358-1999-1-169

Takizad F (2010) Oil Spill Dispersants, Master's Seminar.

Trudel K, Ross S, Belore R, Buffington S, Rainey G, Ogawa C, Panzer D (2003) Technical Assessment of Using Dispersants on Marine Oil Spills in the U.S. Gulf of Mexico and California. In Proceedings of the 2003 International, Oil Spill Conference, American Petroleum Institute, Washington, D.C.: 515-522. https://doi.org/10.7901/2169-3358-2003-1-515

Using Dispersant to treat Oil Slicks at Sea, Response Manual, Cedre France.

Vik AM (2003) New Norwegian Policy on use of Dispersants. In Proceedings of the 2003 International Oil Spill Conference, American Petroleum Institute, Washington, D.C., 2 p. https://doi.org/10.7901/2169-3358-2003-1-273

Wu RSS, Lam PKS, Zhou BS (1997) Effects of Two Oil Dispersants on Phototaxis and Swimming Behaviour of Barnacle Larvae. Hydrobiologia, 352: 9-16. https://doi.org/10.1023/A:1003024500609

Yamada M, Takada H, Toyoda K, Yoshida A, Shibata A, Nomura H, Wada M, Nishimura M, Okamoto K, Ohwada K (2003) Study on the Fate of Petroleum-Derived Polycyclic Aromatic Hydrocarbons (PAHs) and the Effect of Chemical Dispersant Using an Enclosed Ecosystem, Mesocosm. Marine Pollution Bulletin, 47: 105-113. https://doi.org/10.1016/S0025-326X(03)00102-4