

REQUEST FOR QUOTATION

DEMULSIFIER, INHIBITOR AND NEUTRALIZER SELECTION FOR CRUDE OIL ELECTRIC DESALTING, DEWATERING AND ATMOSPHERIC DISTILLATION UNIT

1. SUBJECT

AB "ORLEN Lietuva" (hereinafter – OL Company) invites your company to participate in the tender on selection and supply of deemulsifier, inhibitor and neutralizer for Electric Desalting, Dewatering & Atmospheric Distillation Unit (hereinafter CDU) at Operations Subdivision No. 1, Complex LK-2, selection for CDU unit in 2027–2029.

OL Company plans to conclude long-term contract for 3 years.

Product	2027	2028	2029	Total amount, metric tons
	Amount, metric tons			
Deemulsifier	30	30	30	90
Inhibitor	20	20	20	60
Neutralizer	10	10	10	30

It is planned to purchase about 180 metric tons of chemicals in total. The quantity of additives is planned, but not guaranteed.

You are invited to adjust the additives available in your company to our crude oil blend and select one the most effective additive.

2. GENERAL WORK DESCRIPTION

2.1. Crude Oil Electric Desalting and Dewatering

CDU design capacity is 10MM tons per year.

Desalting is a water-washing operation performed initially at the refinery site for additional crude oil cleanup. Crude oil often contains fine saline water droplets, salt crystals, suspended solids and traces of metals. Large amounts of dissolved salts can affect the crude refining process quite significantly (negative effect in the downstream processes: it can foul heat exchangers, block pipe lines and generally affects the performance of other refinery equipment, due to scale formation, corrosion, catalyst deactivation and etc.).

Desalting involves mixing heated crude oil with washing water, using a mixing valve to ensure a proper contact between the crude oil and the water, and then passing it to electro desalters, where a proper separation between the aqueous and organic phases is achieved. Since emulsions can be formed in this process, there is a risk of water carryover in the organic. In order to overcome this problem chemical **demulsifiers** are added to promote the emulsion breaking. When this operation is performed, an electric field across the settling vessel is applied to coalesce the polar salty water droplets, and, therefore, a decreasing in

water and salt content is achieved. By the polarization of high-tension electric field, the middle and small water droplets in the crude oil emulsion are accumulated to form large water droplets based on density difference between oil and water. Water droplets settle down in the crude oil, and the salts are dissolved in water to be removed together with water.

OL Company is processing different types of crude oil blends (Arab Light, Arab Extra Light, West Texas Intermediate, Troll, Brent, Forties, Johan Sverdrup, Ekofisk, Gullfaks and also stocks (heavy crack products and off-spec products), which contain different salts, mechanical admixtures and substances that promotes water/oil emulsion formation. The concentration of these off spec products in feed to CDU is up to 3,5 % vol. OL is looking for a demulsifier that can break this stable emulsion.

2.2. Atmospheric Distillation

Crude oil contains varying amounts of chloride salts (i.e. mainly CaCl_2 , MgCl_2 , NaCl) that forms HCl due to hydrolysis during heating in the CDU preheat train and associated furnaces. Because presence of a liquid water phase is required, hydrochloric acid corrosion is usually confined to the CDU distillation tower overhead equipment where water is condensed. The most corrosive conditions occur at the initial aqueous dew point, where the majority of the HCl readily enters the first water phase that forms. Other types of salts formed in the process are NH_4Cl and Amine hydrochloride salts in CDU distillation tower overhead systems. These salts are hygroscopic and their deposition and corrosion often occur in the top of the CDU distillation tower, as well as in the tower overhead systems including the overhead piping, overhead condensers, overhead drums, and reflux piping.

In order to protect the condensation equipment against corrosion, **inhibitor solution** and **neutralizer solution** are supplied to the outlet of gaseous mixture. Inhibitor solution in kerosene fraction is supplied by pumps to outlet pipelines of K-101 and K-102 (respectively) overhead distillates. Neutralizer is used in K-101, K-102 to normalize pH of overhead distillates (overhead products) condensation equipment medium. Neutralizer solution in kerosene fraction is supplied by pumps to outlet pipelines of K-101 and K-102 (respectively) overhead distillates. Neutralizer is dosed considering the readings of pH-meters in the water pipelines from T-101, T-102. The corrosion level is measured by the iron concentration in K-101, K-102 overhead water from drums T-101 and T-102.

OL Company is using NaOH solution to convert Ca and Mg chlorides to NaCl that will not hydrolyze. Caustic soda solution is supplied to crude oil pipeline upstream the second group heat exchangers and to crude oil pipeline to K-101 by calculating 0,005–0,015 kg of pure NaOH for one ton of crude oil. Upon temperature increase in the second group heat-exchangers the disintegration of chloride salts occurs, which remain in crude oil after desalting and dehydration, and hydrochloric acid is formed, which is neutralized to minimize its effect on the equipment by supplying 1,5–2 % caustic soda solution.

Table 1. List of materials for a particular equipment

Equipment	Material
Pipelines	Steel 20
Air-cooled exchangers tube bundles	ЛАНШ-77; 12X18H10T
Reflux drum T-101	R52-6b
Reflux drum T-102	R52-6b
Reflux drum T-103	ВсТ5сн5

3. SCOPE OF WORK

3.1 Demulsifier Selection

OL Company is ready to provide samples of most frequently used crude oil, off-spec products for analysis and for choosing the best demulsifier also unit operating data, if necessary. OL Company needs to get test data from your company of analyses results of interaction between demulsifier and oil/off-spec samples together with maximum guaranteed quantity of dosage, at which the separation will be sufficient with provided samples (ppm/t).

OL Company is looking for demulsifier that can satisfy requirements listed below:

1. Must provide a good degree of water-oil solubility;
2. Must be soluble in hydrocarbons;
3. Must have good surface activity to replace natural emulgators;
4. Must provide good emulsion separation dosing small amounts of deemulsifer while processing different crude oils with off-spec streams up to 3,5 %vol;
5. Deemulsifer must not cause equipment corrosion;
6. Melting/freezing point must be $\leq -30^{\circ}\text{C}$;
7. Pour point must be $\leq -30^{\circ}\text{C}$;
8. Deemulsifer must be effective in mixtures that contain:
 - 8.1. Mechanical (inorganic) impurities: 0,03 wt% average, 0,1 wt% maximum;
 - 8.2. TAN: 0,11 mg KOH/g average, 0,5 mg KOH/g maximum;
 - 8.3. Chloride salt content: 20,8 mg/l average, 200 mg/l maximum;
 - 8.4. Paraffin content: 3,5 wt% average, 13 wt% maximum;
 - 8.5. Asphaltene content: 1,4 wt% average, 2,4 wt% maximum.

3.2 Inhibitor and Neutralizer Selection

To select proper inhibitor and neutralizer we can provide preflash and atmospheric columns operating data and send straight run naphtha after each column together with overhead water samples. OL Company needs to get test data from your company of analyses results of test trials together with maximum guaranteed quantity of dosage (ppm/t).

OL Company is looking for inhibitor and neutralizer that can satisfy requirements listed below:

1. Maximum protection against corrosion at a minimum concentration/dosage rate;

2. Not interfere with the normal technological regime;
3. Not impair the quality of products and adversely affect the catalyst that is used in the downstream processes;
4. Melting/freezing point should be $\leq -30\text{ }^{\circ}\text{C}$;
5. Pour point must be $\leq -30\text{ }^{\circ}\text{C}$;
6. Must be soluble in hydrocarbon solvents (straight run kerosene).

3.3 General requirements for selection

3.3.1 Performing of test in laboratory:

- For demulsifier (suggested evaluation method): please evaluate the phase-separation effectiveness by means of separation-time, quantity, quality and interface-sharpness;
- For inhibitor (suggested evaluation method): it can be evaluated by exposing treated with inhibitor corrosion coupons (the material of such coupon must be the same as per Table 1) to the corrosive environment that is interested in (corrosive media, temperature, pressure, water-quality);
- For neutralizer (suggested evaluation method): the effectiveness of neutralizer is dependent on the media that needs neutralizing in balance with the salt-properties that are being formed. One should not only look into the pH-curve (pKz), but also into the properties of the salts that are being formed from the reaction between the neutralizer-base with the acid species present in the water-phase;
- OL Company needs to get test data from your company of analyses results of test trials;
- Based on the results OL Company will choose the supplier for 3-year period from 2027 to 2029.

3.3.2 After selecting in your consideration best suitable demulsifier, please send it (min 100 ml) for testing to OL Company laboratory (QA/QC Center), together with recommended dosage mg/kg. Address for sending samples is AB ORLEN Lietuva Mažeikių St. 75, Juodeikiai village, LT-89453 Mažeikiai District Municipality, Lithuania.

3.4 Technical assistance

3.4.1 The scope of technical assistance should include the following but not limited to:

- Regular technical follow-up meeting to redefine refinery expectations and targets to achieve;
- On site assistance of the Seller's representative;
- Treatment follow up according to monitoring setup and KPI Analysis of the chemicals performance.

3.5 Other Requirements

- It is desirable that the supplier takes care of the removal (and disposal) of empty containers from the refinery.
- Your offer must be submitted in purchasing platform. Technical and commercial parts must be provided in separate documents. The supplier should provide to OL Company price of each chemical separately (only in commercial part).
- Please indicate detail information of product packaging: type, size, material, etc.
- All products must be registered acc. to REACH regulations.
- Please provide SDS in Lithuanian language in accordance with Regulation (EC) No. 1907/2006 (REACH) and all its subsequent amendments as set out in Commission Regulation (EU) 2020/878. If you cannot provide a Lithuanian SDS, please provide it in English, but in case of contract award you will have to submit a Lithuanian SDS within the time frame established by OL Company.
- Delivered Goods must be labelled in Lithuanian language.
- Please provide shelf guarantee.

4. INFORMATION FOR COMMERCIAL PROPOSAL

4.1 Commercial proposal shall contain:

- 4.1.1 Unit price of products per kg/ EUR (no VAT) acc. to INCOTERMS 2020; DDP ORLEN Lietuva Mažeikiai, Lithuania;
- 4.1.2 Payment terms;
- 4.1.3 Country of Origin;
- 4.1.4 Customs tariff number;
- 4.1.5 Guaranteed dosage rates of products and Liabilities.

Your offer will be evaluated in provided technical and commercial conditions. AB ORLEN LIETUVA reserve the right to select at its own option a winning bidder, winning bidders or other persons, and negotiate with them a part or entirety of the submitted bids and to conclude agreements with more than one bidder selected through negotiations, where the scope of a given agreement can cover the entirety or a part of works. Moreover AB ORLEN LIETUVA reserves the right to cancel this invitation for tenders and withdraw from negotiations without giving any reason. Bidders are not eligible for any claims against the Inviting Party in this respect.