

EXECUTIVE SUMMARY

The technology status report on oil-field chemicals covers the classification, function, production technologies, end-uses, international scene, status of Indian Industry, technological gaps etc. in respect of drilling oil field chemicals. This report enable one to assess the state of art of the Indian Industry, identify technological gaps and deduce the measures that need to be taken to fill the gaps including the need for import of technology if so required.

The oil-field chemicals used in the various operations for completion of any oil well can be grouped into the following categories.

- Drilling fluid/Mud chemicals and Mud additives
- Cement and cement additives
- Production chemicals
- Water Injection Chemicals
- Well Stimulation Chemicals
- Process Chemicals.

Drilling fluids or liquids perform a variety of functions that influence the drilling rate, the cost, efficiency and safety of drilling operations. There are many types of drilling fluid systems available like water base muds, oil base muds, stable foam muds, air or gas base muds from which the right system may be chosen. Main drilling mud additives include viscosifying agents, fluid loss control agents, drilling fluid dispersants and corrosion inhibitors.

Cement and cement additives are considered to be critical inputs in the completion of any oil and gas well. The increase in demand for cement suitable for oil and gas wells led to the establishment of API codes by the American Petroleum Institute and nine classes of cements for the oil industry have been classified. Two of the nine classes of cements, the classes G and H, are called basic oil well cements. Main cement additives retarders, turbulence inducers and fluid loss controlling agents.

Production chemicals are used to keep the oil mobile after shut down or under cold conditions, remove emulsified water and prevent corrosion of the pipeline.

A stimulation fluid is utilised to improve the flow of hydrocarbons. Water injection chemicals are used for pressure maintenance of the reservoir to enable higher oil recovery. Process chemicals are required for production of LPG and also sulphur recovery from H.S.

Although a large number of chemicals are used as oil field chemicals and their requirement varies from oil-field to oil-field, the most essential and important oil-field chemicals can be summarised as :

OIL FIELD CHEMICALS	PRIME USE
Chrome lignite	High temperature drilling fluid conditioning agent
Chrome lignosulphonate	Drilling fluid dispersant/thinner
Diaseal M or equivalent	Mud loss controlling agent
Drilling detergent	Drilling fluid surfactant
Polyanionic cellulose	Fluid loss control agent
Resinated lignite	High temperature fluid loss reducing agent/shale stabilising agent
Guar gum	Viscosifying agent
Spotting fluids	Stuck pipe releasing agent
Sulphonated asphalt	Shale stabiliser
Gilsonite	Shale stabiliser
XC-polymer	Viscosifier
Carboxy methyl starch	Fluid loss control agent
Barite/Hematite	Weighting agents in drilling fluid
Class "G" oil well cement	For oil well cementation
Turbulance inducer	Cement slurry thinner
Fluid loss reducer	For controlling fluid loss property of cement slurry
Retarder	To retard thickening time of cement slurry
CMHEC (carboxy methyl hydroxy ethyl cellulose)	Retarder / fluid loss reducer
Pour point dispersant	Flow improver for crude oils
Catalyzed ammonium bisulphite/amines	Corrosion inhibitor
Triethylene glycol	Dehydrater for oil
Ethyl mercaptan	Odouring agent in LPG
Methyl diethanol amine/ Diethanol amine	Extraction of H ₂ S
Sulphur catalyst	Sulphur accelerator
Bentonite/calcium chloride	Cement accelerator
Gilsonite	Lost circulation material

INDIAN SCENARIO

During the past ten years a major break through in the production of oil field chemicals has taken place in India. The satisfactory field performance of some of the specialist chemicals developed as per international standards has greatly reduced the dependence on imports. The major indigenously manufactured oil field chemicals are chrome lignosulphonate, ferrochrome lignosulphonate, polyanionic cellulose, sodium carboxy methyl cellulose, chrome lignite, sulphonated asphalt, resinated lignite, diaseal M equivalent, EP lubricant, spotting fluid, modified guar gum, oil well cement class "G", cement additives, oil well detergents, de-emulsifiers, corrosion inhibitors, EDTA, pour point depressant, biocides, polyelectrolytes, scale inhibitors etc. But still FCLS, Dextrin, polyanionic cellulose etc. are being imported in the country. Kalpana Chemicals Private Limited, Dai-Ichi Karkaria Pvt. Ltd., Hindustan Magcobar Chemicals Ltd., Baker Oil Treating (India) Ltd., Hindustan Gum and Chemicals Ltd. are the major manufacturers of oil field chemicals.

INTERNATIONAL SCENARIO

The major international manufacturers of oil-field chemicals are Baroid, International Drilling Fluids, M.I. Drilling Fluids, Union Carbide Corporation, Floridine of USA, Hoechst and Ewabo of Germany, Avebene and Rhone Poulenc Chiemic of France, Shell and BP Chemicals of London.

PHPA (hydroxy poly acrylamide) based drilling mud, low solid 100% oil mud and biopolymer fluids are the latest developments at the international level.

RESEARCH AND DEVELOPMENT

During the past ten years, a major break-through in the production of oil-field chemicals has taken place in India. The satisfactory field performance of some of the speciality chemicals developed as per international standards has greatly reduced the dependence on imports. Availability of speciality chemicals, agro products and minerals required for oil industry non provide opportunities for export. This development has become possible both through indigenuous R&D efforts and/or through technical collaboration with foreign manufacturers. ONGC has got excellent research and development centres like Institute of Drilling Technology (IDT) equipped with modern sophisticated equipments, facilities and services to identify / evaluate / develop oil field chemicals. IDT has developed FCLS, CFL, sulphomethylated lig-

nite, organophilic lignite, slag cement, class "G" cement, low temperature retarders, turbulence inducers etc.

Dai-Ichi Karkaria Pvt. Ltd., India has made significant developments in the field of pour point dispersants (PPD). Besides the PPD, Dai-Ichi Karkaria has also developed acid corrosion inhibitors, emulsifiers etc. The Kalpana Chemicals Pvt. Ltd. is having the distinction of indigenously developing products in its own research and development laboratories, like sodium carboxy methyl cellulose, causticized lignite, chrome lignite, resinated lignite, sulphonated asphalt, extreme pressure lubricant, Diaseal M, spotting fluid, polyanionic cellulose etc.

Similarly, Hindustan Gum and Chemicals Limited have developed Hydroxy propyl guar gum, XC-polymer chemicals and gelling agents which have still to be approved by ONGC for their suitability.

CONCLUSIONS

1. Drilling fluid and fluid additives, cement and cement additives, production chemicals, water injection chemicals, well stimulation chemicals and process chemicals are the various classes of oil field chemicals used in the different operations for drilling of any oil well.
2. Drilling fluids or muds perform a variety of functions like removal of cuttings, lubrication of drill pipes and bits, control of sub-surface pressures, protection of well bores, releasing sand and cutting at the surface etc. There are many types of drilling fluid systems available like water based muds, oil based muds, stable foam muds, air or gas based muds etc.
3. Portland cement still remains the primary cementing material in use for cementing of oil and gas wells, zonal isolation, casing protection and bore hole support. The increase in demand for cement suitable for oil and gas wells led to the establishment of API codes by the American Petroleum Institute. The API has classified nine classes of cements for the oil industry. Two of the nine classes, the class G and H, are called the basic oil well cements which provides greater uniformity, more controlled physical and chemical properties, greater compactibility with additives and improved storage stability.
4. Production chemicals are used to keep oil mobile after shut down or under cold conditions, remove emulsified water and prevent corrosion of pipeline. A well stimulation fluid is utilised to improve the flow of hydrocarbons. Water injection

chemicals are used for pressure maintenance of the reservoir for higher oil recovery. Process chemicals are required for production of LPG and sulphur recovery from H₂S.

5. The major by-products of oil field operations are residual oil drill mud, oil-field brine, oil bearing water and other oil field chemicals. All these residual by-products require adequate treatment and safe disposal in order to prevent the environment from getting contaminated with offensive substances present on these by-products.
6. During the past ten years a major breakthrough in the production of oil field chemicals has taken place in India. The satisfactory field performance of some of the speciality chemicals developed as per international standards like lignosulphonates, polyanionic cellulose, sodium carboxy methyl cellulose chrome and resinated lignites, sulphonated asphalt, cement additives, pour point depressant, corrosion inhibitors, scale inhibitors etc. has greatly reduced our dependence on imports. The major manufacturing units of these oil-field chemicals are Kalpana Chemicals Pvt. Ltd., Dai-Ichi Karkaria Pvt. Ltd., Hindustan Magcobar Chemicals Ltd., Baker Oil Treating (India) Ltd., Hindustan Gums and Chemicals Ltd. and Nutan Chemicals.
7. Major international manufacturers of oil field chemicals are Baroid, International Drilling Fluids, M.I. Drilling Fluids, Union Carbide Corporation, Floridine of U.S.A., Hoechst and Emwabo of Germany, Avebene and Rhone Poulenc of France, Shell and BP Chemicals of London. Latest developments in the oil-field chemicals are PHPA (Hydrolyzed Polyacrylamide) based drilling muds and biopolymer drilling fluids for horizontal well drilling.
8. Chrome and resinated lignites, sulphonated asphalt, modified guar gum, cement class GAPI (HSR), Pour Point depressant (PPD) are some of the important chemicals which were developed in the country by indigenisation efforts of IDT (Institutes of Drilling Technology), Kalpana Chemicals, Hindustan Magcobar, Dai-Ichi Karkaria etc. Cement additives and carboxy methyl hydroxymethyl cellulose are the major thrust areas for indigenisation.

RECOMMENDATIONS

1. Although in recent years a large number of oil-field chemicals like lignosulphonates, lignites, pour point depressants, basic cements, corrosion inhibitors, bactericides, surfactants, scale inhibitors, de-emulsifiers and de-oilers etc. have been indigenised in the country, still various oil field chemicals including

Dextrin, Pipe lax, FCLS, CLS, EP lube, and spotting fluid are being imported in the country. Efforts need to be accelerated for indigenisation of these chemicals, which are being imported.

2. India is rich in production of starch, Kernel Tamarind Powder (KTP) and guar gum. The application of these materials in the oil industry is not fully exploited. These products can be developed to produce valuable gelling agents, water loss reducing compounds, viscosifiers etc.
3. India has vast resources of minerals used in all water based mud systems like Baryte and Bentonite. Thus there is lot of export potential for these oil-field chemicals, which should be exported.
4. Maintenance of quality of the products being used in the petroleum industry is absolutely vital, as variation in the product quality, particularly of the production and transportation chemicals, may seriously hamper crude production and crude availability to the refineries. Sometimes, indigenous products have been found to exhibit batch to batch variation in product quality and hence require extra efforts to analyse each batch before use.
5. The procurement of various oil field chemicals is based on rigid and definite programmes of various oil field operations. Thus manufacturers should make extra-efforts to deliver oil-field chemicals within set time frames, otherwise vital operations get seriously affected.
6. Sometimes, manufacturers also have problems in indigenous development of oil field chemicals due to non-availability of raw materials indigenously. Efforts should be made for the development of various raw materials required for production of important oil-field chemicals.