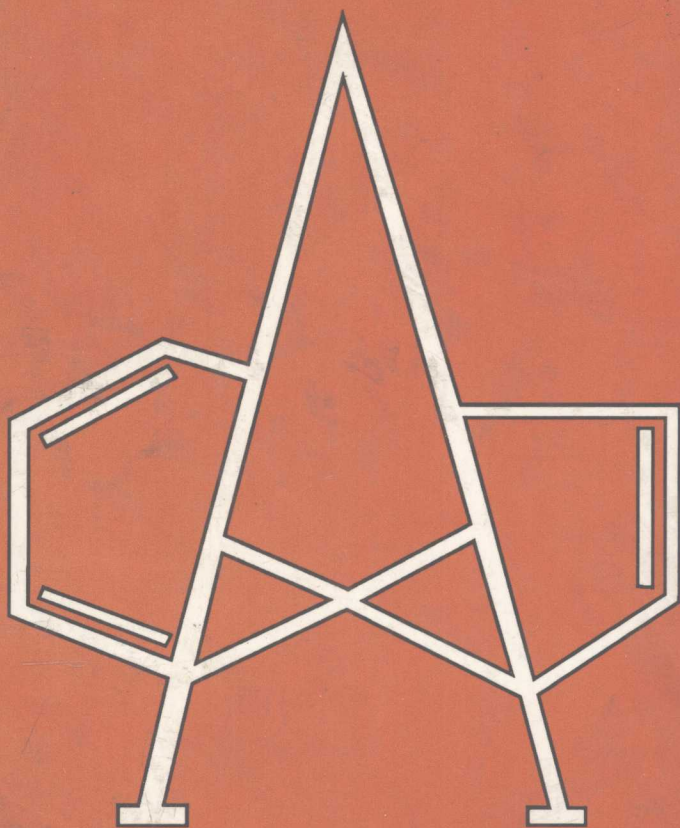


Chemicals in the Oil Industry:

Developments and Applications



Edited by P.H. Ogden

Chemicals in the Oil Industry: Developments and Applications

Edited by
P.H. Ogden
Akzo Chemie UK Ltd



The Proceedings of a Symposium Organised by the North West Region of the Industrial Division of the Royal Society of Chemistry with the Royal Netherlands Chemical Society as part of the Annual Chemical Congress held 8-11 April 1991 at Imperial College, London

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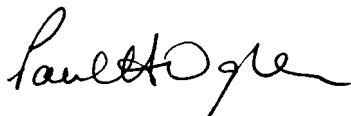
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Preface

The Northwest Region of the Society's Industrial Division held its first Chemicals in the Oil Industry Symposium at Manchester University in 1983. At that time the Oil Industry was considered by many major chemical companies to be an attractive market offering opportunities for diversification in co-operation, or competition with existing oilfield service companies. During the intervening eight years, collapsed oil prices together with the effects of tightening environmental regulations have caused several of these companies to reconsider their position and latterly there has been a degree of rationalisation. Consequently, although much of the fourth symposium addressed technical and environmental issues, attention was also given to a review of recent market development and how this is expected to continue in the foreseeable future. The scope of the conference was extended to include some aspects of refinery operations where environmental pressures are also leading to significant changes.

The meeting was jointly organised by The Royal Society of Chemistry and the Royal Netherlands Chemical Society. It consisted of six distinct sessions, each with its own convener and I wish to express gratitude to my co-conveners, T.A.B.M. Balsman (Shell Chemicals), M. Fielder (B.P. Exploration), D. Graham (B.P. Research), G. Pusch (Technische Universitat Clausthal) and P.M. van der Velden (Servo Delden).

The RSC is also grateful to the management of Akzo Chemicals, BP, Servo, and Shell Chemicals for their generous sponsorship of the symposium.



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Future Market Aspects of Oilfield Specialty Chemicals

Christopher W. Houston

COLIN A. HOUSTON AND ASSOCIATES, INC. 689 MAMARONECK AVENUE. PO BOX 416. MAMARONECK, NEW YORK 10543. USA

The oilfield specialty chemical market has undergone many changes over the past 10 years. Looking back to 1980-1981, the oilfield chemical market was robust as oilfield activity was peaking at 4,500 rigs in the U.S. and 5,800 rigs worldwide. The following Figure 1 shows the effect oil prices have on the rig count.

At that time, a fever-pitched industry sought new specialty chemicals for improved drilling, completion and workover, cementing, stimulation, production, and particularly enhanced oil recovery (EOR) techniques. After all, crude oil was reaching \$40/barrel and the outlook showed \$100/barrel by the end of the decade.

Complicating matters, however, was the fact that while higher oil and gas prices were spurring oilfield activity they were also pushing the world into a recession. And, as commodity chemical usage was declining rapidly, many chemical companies, seeking relief from the cyclicity of commodity products, ventured into the oilfield specialty chemical segment.

Figure 2 shows oilfield chemical usage as it stood in 1980 by segment.

As oilfield chemical usage grew, demand for improved chemicals was also growing. Industry sought new products from chemical and oil company R&D centers, but as this work was being accomplished, the first signs of cracks in the oilfield bubble were being seen.

The subsequent decline in oil price and concurrently oilfield activity caught most people by surprise. The oilfield service and chemical industry, in particular, had built new plants, warehouses, and labs to handle the burgeoning market. Oilfield personnel were at an all-time high at most service companies such as Dresser, NL Baroid, Halliburton, Dowell, and Baker.

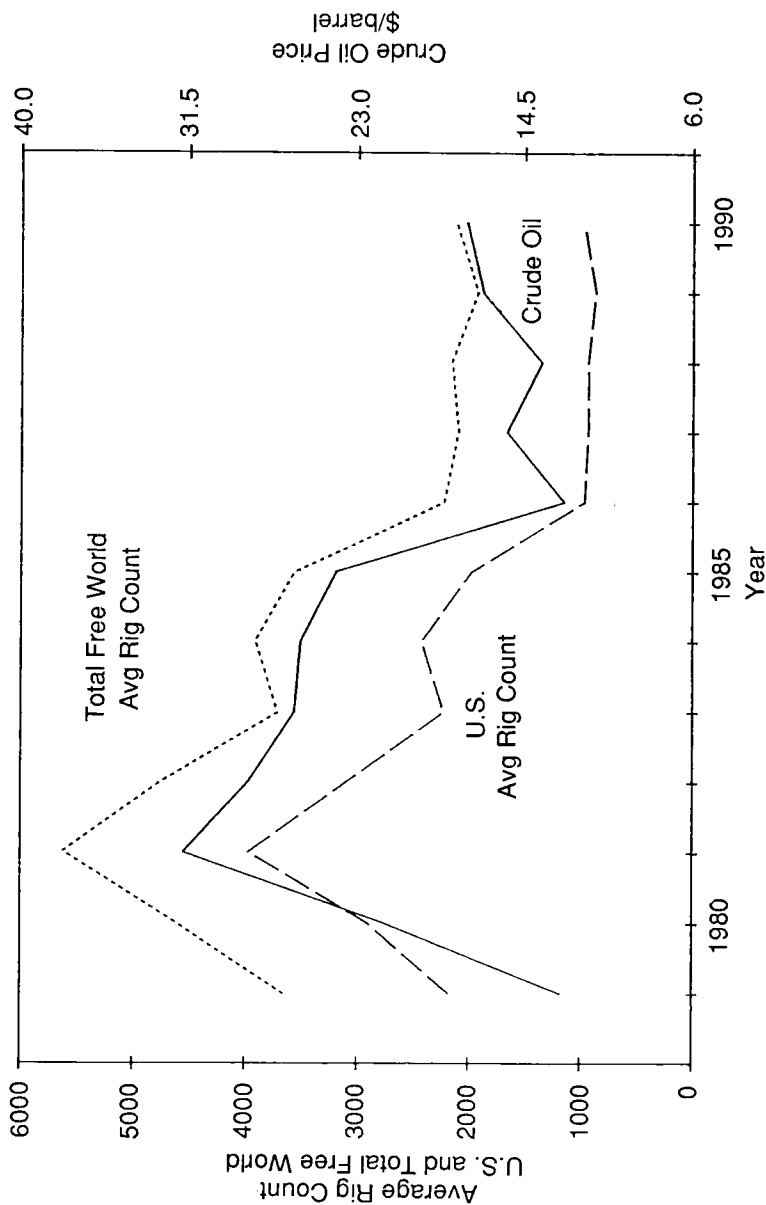


Figure 1

Source: Oil & Gas Journal

AVERAGE RIG COUNT VS. CRUDE OIL PRICE, 1979 - 1990

Figure 2	
WORLDWIDE OILFIELD CHEMICAL MARKET, 1980 (million dollars)	
	Service Value
Drilling	2400
Completion and Workover	300
Cementing	1800
Stimulation	1500
Production	600
EOR	150
	6750
Source: Colin A. Houston & Associates, Inc.	

Figure 3 shows total oilfield service company employment from 1982 to 1990.

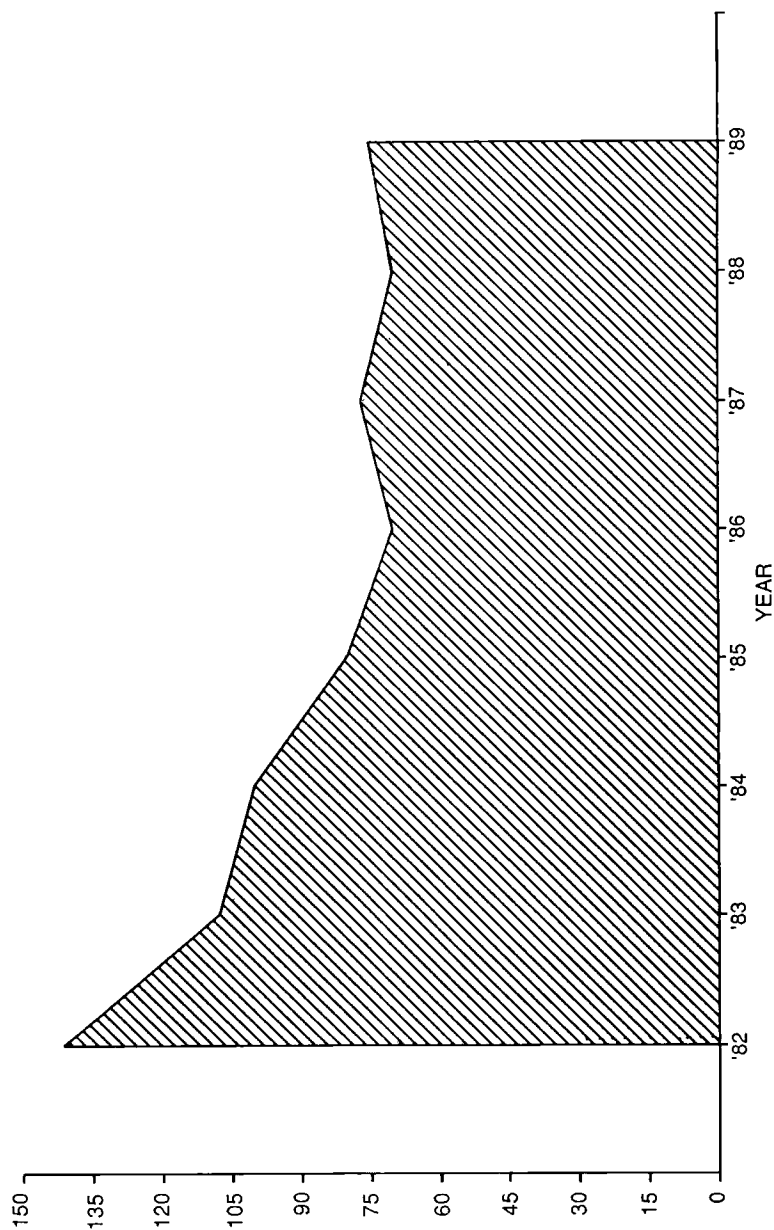
Needless to say, the resulting decline in oilfield activity was a devastating shock to those companies that had invested heavily in the growth of oilfield chemicals. Oilfield service companies were forced to sell equipment, close stock points, and lay off personnel to compensate for a rapidly decreasing market. The scars left from this experience are still evident in most companies which participated in the surge of the late 1970s into the early 1980s.

Of course, the sobering experience of 1983-1985 was but a mere shadow of the forthcoming devastation of the 1986-1987 oil price collapse. While \$25-30/barrel oil had dampened enthusiasm for new entrants, most surviving oilfield service companies were still profitable during the period of 1983 to 1985.

The 1986-1987 oil price collapse was certainly a negative factor in determining oilfield chemical selection. Most operators had thought sufficient cut-backs had been made in 1983 to 1985 to compensate for \$25 to \$30/barrel oil. When \$10/barrel oil arrived, staff reductions were again undertaken but additional focus was placed on slashing oilfield chemical costs. (See Figure 4.) Whenever and wherever reductions in operating costs were possible, operators made them. The easiest way to drive costs lower was to competitive bid, where price was the key selection criteria for choosing any oilfield chemical. Bidding became so popular in all phases of oilfield chemical usage that it quickly took its toll on



Figure 3
U.S. OIL & GAS FIELD SERVICES - TOTAL EMPLOYEES, 1982-1990



Source: IPAA Cost Study Committee, Oct. 1990

Figure 4
U.S. INDEX OF DRILLING MUD ADDITIVES COSTS, 1982-1989
(1984 = 100)

the oilfield chemical service companies as consolidation was necessary in order to compensate for lower oilfield activity and substantially reduced prices. Figure 4 traces oilfield drilling fluid costs from 1982 to 1989. As can be seen in the figure, drilling fluid costs dropped 47 percent over the period in the U.S. Other oilfield chemical services had similar price erosion.

Thus by 1988 the oilfield chemical market took on quite a different tone as bankruptcies, divestitures, LBOs and mergers created a new set of players in the oilfield chemical service marketplace.

From 1988 to 1990 a new tone of cautious optimism has been present as oil prices have mostly fluctuated between \$15 and \$20 per barrel. Rig activity has gradually increased during the period from a post-World War II low of 650 rigs in 1986/1987 in the U.S. to 1050 rigs in March of 1991. The Iraqi invasion of Kuwait and subsequent run-up in oil prices has had a negligible impact on the oilfield chemical market. Most operators see oil prices hovering in the \$15 to \$25/barrel range over the next ten years and are planning accordingly.

That is a brief history of the oilfield chemical market over the past 10 years. Currently, (see Figure 5) the worldwide market for oilfield chemicals and services is \$5.4 billion. The market is split 55:45 in favor of the international segment. Of course, the international market will continue to grow during the 1990s while the U.S. market will remain relatively flat.

Each oilfield chemical segment presents unique marketing challenges for the specialty chemical manufacturer. Depending on the segment, specialty chemicals may be sold directly to the service company, to the operator, or to a blender. This matrix of end users is one of the chief marketing problems for the specialty chemical company.

As mentioned previously, the current worldwide market for oilfield chemicals with service is \$5.4 billion. Drilling fluids represent 26 percent of the total market, while cementing and stimulation take up another 57 percent. The bulk of the products used in these two segments are commodity chemicals such as barite, bentonite, and hydrochloric acid. However, the need for specialty chemicals is increasing as oilfield work moves into more hostile and environmentally sensitive areas. Figure 6 summarizes the current worldwide oilfield chemical market with respect to sales by segment and the amount of specialty chemicals being used.

While at first a large dynamic specialty chemical market appears, the complexities of the usage of these products is vast. (See Figures 7A and 7B.)

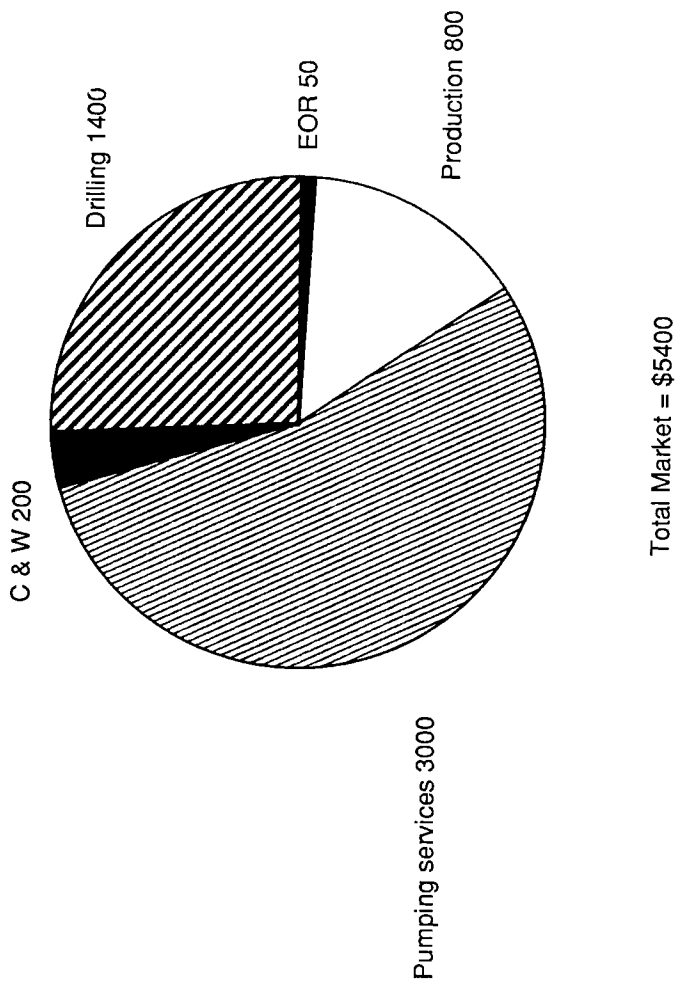


Figure 5
WORLD OILFIELD CHEMICAL MARKET - 1990
(million dollars)

Figure 6			
WORLDWIDE OILFIELD CHEMICAL MARKET - 1990			
	Total Service Market (billion \$)	% Specialties (of total service market)	Manufacturers Value of Spec. Chemicals (million \$)
Drilling	\$ 1.4	20%	\$275
C&W	\$ 0.2	5%	\$10
Cementing/ Stimulation	\$ 3.0	10%	\$300
Production	\$ 0.8	45%	\$360
EOR (chemical)	\$ <0.1	90%	\$45
Total	\$ 5.4	18%	\$990

Figure 7A Drilling

- Approximately 50,000 wells drilled worldwide in 1990 (peak was 100,000 in 1981).
- 500+ end users worldwide with markets ranging from \$100,000 to \$500 million.

Figure 7B Drilling

- Specialty chemicals are generally not sold to the end user/oil company. They must be first sold to a drilling fluid service company (e.g. M-I, Baroid, Milpark, IDF) which will blend the product into its own formulation.
- New specialty chemical products must be evaluated by both the oil company and the drilling fluid service company prior to field usage.
- Improved viscosifiers, shale control additives, oil-based alternatives are being sought.

In drilling, oilfield service companies such as M-I, Baroid, Milpark and IDF are not chemical manufacturers. While they do process barite and bentonite, and have ventures in lignosulfonates, in most other cases they depend heavily on specialty chemical suppliers to provide polymers, corrosion inhibitors, biocides and defoamers.

Prior to 1980, chrome lignosulfonate, gelled bentonite, and oil-based drilling muds were used in 85+ percent of all the wells drilled. (See Figure 8.) Specialty chemical usage was limited. However, as drilling ventured into more hostile environments (deep, offshore, horizontal, inclinate), better performing products were required.

Spearheading many of the changes were environmental concerns regarding disposal of chrome lignosulfonates and oil muds (especially offshore). Additionally, fine clay formation damage potential has resulted in a trend towards polymer muds.

Bringing new products into the drilling fluid segment requires a great deal of patience. Two approval procedures are required: one by the DFSC and another by the oil company operator. Each has its own priorities for evaluating new products which are very complicated. The procedures to assess a new product can be expedited if an immediate need is determined.

Specialty drilling chemical oilfield marketing requires a multi-pronged effort whereby numerous contacts are necessary to determine a product's true value. This web of contacts will produce varying opinions on a product's potential which range from extremely low to very high. (See Figure 9.)

Assessing the real potential for a new drilling fluid additive is especially difficult because of a complex evaluation process. Specialty chemical companies typically utilize a push/pull strategy of marketing for drilling fluid additives.

The push/pull strategy requires contacting both the DFSC and the oil companies to test the product against existing products. The specialty chemical company needs both the DFSC to help formulate the product and the operator to provide another evaluation of the product's worthiness. It takes a substantial amount of patience to introduce a new drilling fluid additive because of the complexity of the evaluation process.

Will this change in the future? Possibly, as drilling conditions become more hostile or environmentally sensitive, new drilling fluid specialty chemicals will be required. (See Figure 10.)

Over the past three years, for example, a number of new specialty drilling fluid additives have been introduced. A wide range of needs has developed for new specialty products which are environmentally safe, offer high temperature, pressure and divalent cation resistance, and are, of course, cost-effective. The products introduced have substantially improved the drilling practice via lower overall costs to drill difficult wells. The table below shows a brief list of new products for the drilling industry.

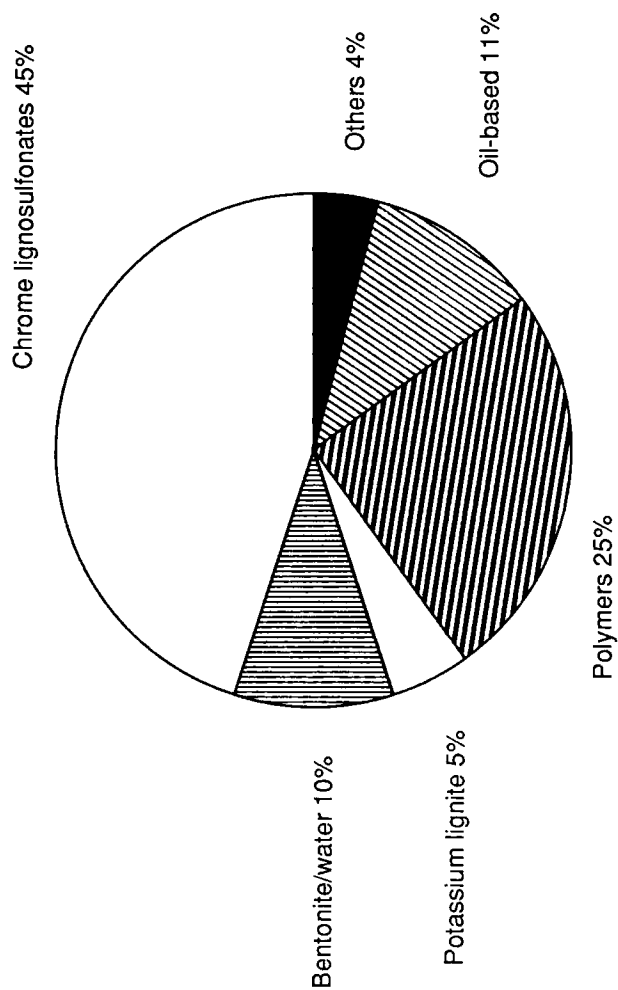


Figure 8
U.S. DRILLING FLUID SYSTEMS - 1990
(Percent of Total Drilling Fluid Market)