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DEVELOPMENT OF PETROCHEMISTRY IN AZERBAIJAN

(brief review of the status and development of petrochemical science and industry in the Azerbaijan Soviet Socialist Republic)

by R.G.Ismailov, academician, doctor of techn. Sc., professor, president of the Academy of Sciences of the Az.SSR

Moscow, September 1969

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DEVELOPMENT OF PETROCHEMISTRY IN AZERBAIJAN

by R.G.Ismailov

Summary

1. The foundation of the petrochemical industry of Azerbaijan was laid in the 30-s. Extensive development of petrochemical science and industry refers to the 50-60-

2. The expediency of the construction of initial crude oil distillation units having a capacity of 6-10 million t/y has been shown as in this case only all the main succeeding petrochemical processes can be supplied with raw materials.

3. For the recent two decades extensive investigations into the pyrolysis of oil production and oil processing casinghead gases, middle and heavy petroleum distillates have been conducted; a new improved pyrolysis technology as well as a new integrated scheme for the utilization of all pyrolysis products has been elaborated. The results of these investigations have found wide commercial application.

4. The technology for the production of high-purity ethylene and propylene has been developed; on the basis of these products large-scale processes aimed at the production of polymers and other valuable petrochemical products have been elaborated, for instance direct ethylene hydration.

5. Important studies have been performed in Azerbaijan

aimed at further development of the SR-industry (production of divinyl and isoprene by catalytic dehydrogenation of oil processing gases, development of the technology for ethylene-propylene rubber production, elaboration of oxidation & dehydrogenation processes).

6. Azerbaijan's scientists have carried out interesting investigations on hydrocarbon oxidation and oxidative ammonolysis (production of acrolein, maleinic and phthalic unhydrides, ethylene and- propylene oxides, acrylonitrile etc).

7. The production of chloroorganic compounds proves to be one of the key trends in Azerbaijan's petrochemical industry.

8. One of the new trends in the works of Azerbaijan's scientists is to obtain polimeric materials (elaboration of a new original technology for polyethylene production using oxidation catalysts).

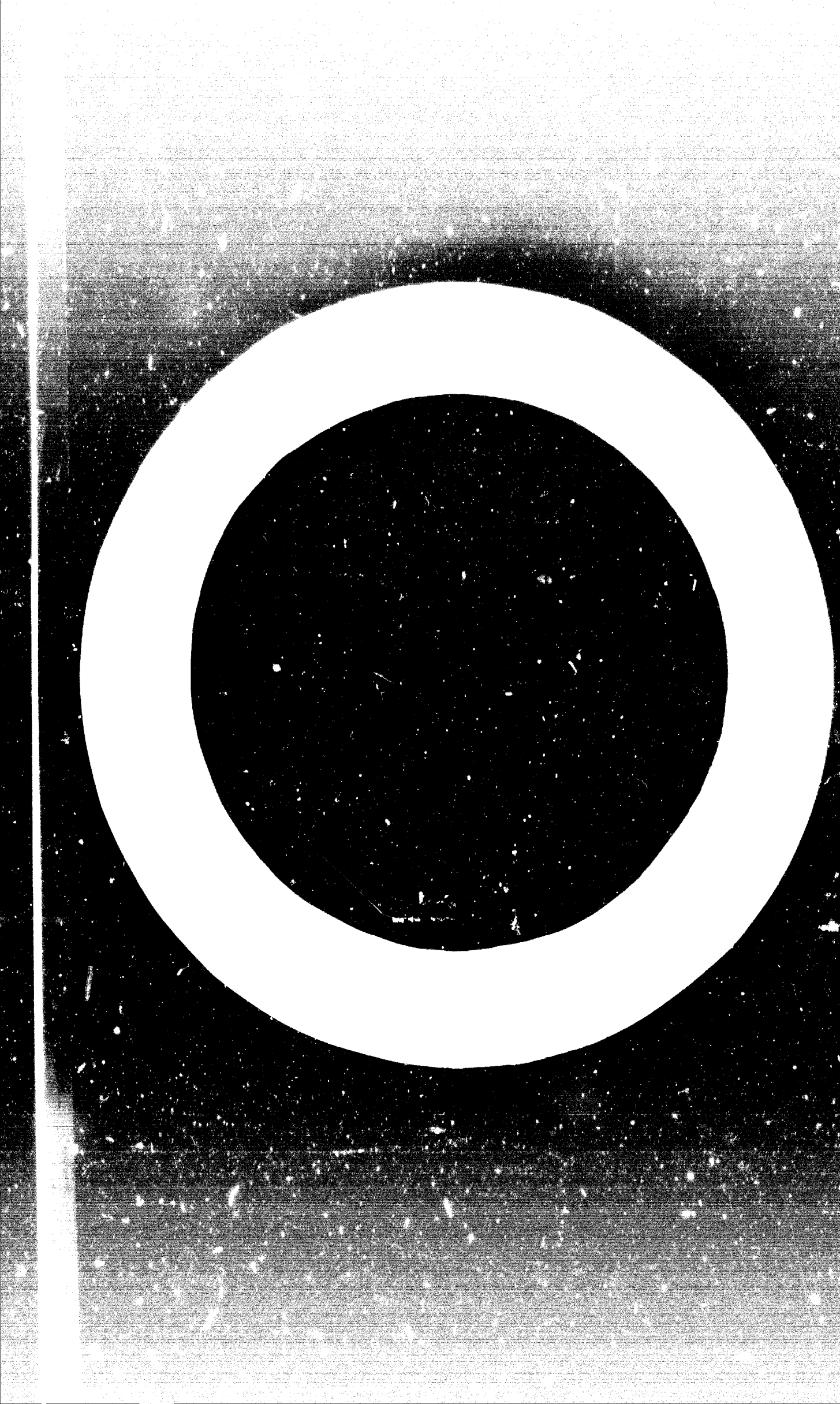
DEVELOPMENT OF PETROCHEMISTRY IN AZERBAIJAN

by Acad M G Kerimov

Allow me to dwell briefly in my paper the ways of development and prospects of petrochemistry in Azerbaijan to dwell on the work of the Azerbaijan scientists in the field of petrochemistry as the contribution into the branch of science and technology of the Soviet Union.

It is known that as early as before the revolution Azerbaijan was one of the world's main centres of oil production and processing. However the technical level of development of this industry was very low. The oil industry was practically completely in the hands of foreign monopolists, we had neither national cadres, nor scientists, nor highly educated specialists.

After Soviet power was established in Azerbaijan as early as in the 20-s the oil processing industry had been subjected to fundamental reconstruction. It was at this time the foundation had been laid for further development of the oil processing industry and for the creation of a new industry branch - petrochemical industry. At that time there were created scientific centres for petroleum chemistry. In the 30-s and 40-s petrochemical science and industry experienced especially vigorous and rapid development although in the course of these years the republic lost its former position in the field of oil production and processing (The volume of oil production not only remained but increased somewhat, while the share of it in the country's total production has sharply decreased).



As far as the manufacture of oil processing products is concerned, especially the production of lubricating oils and new petrochemical products, our institute occupies one of the leading positions in the Soviet Union.

One of the few institutes where theoretical problems of technology of organic processes where oil is considered as the raw material in our country. We consider the investigations in this field to be of great importance for the choice of optimum schemes of integrated petrochemical complexes as well as for the solution of problems associated with their design and system of automation, including solution of optimization problems.

Low molecular unsaturated and aromatic hydrocarbons prove to be the basic raw material for the petrochemical industry. Low molecular unsaturated hydrocarbons are either directly involved in [illegible] as a result of reaction with chlorine, nitric acid, oxygen containing compounds as well as aromatic hydrocarbons form various valuable organic products, monomers and intermediates for the production of synthetic polymers, [illegible] surfactants, pesticides, various solvents and other products which are of great importance for the petrochemical industry.

The above mentioned petrochemical compounds and intermediates are produced by such petrochemical processes as steam cracking, catalytic cracking as well as catalytic and thermal reforming.

The [illegible] institute and its branches have made a great contribution into the solution of

a complex of problems associated with providing the ever developing petrochemical industry with raw material, and the elaboration of the basic petrochemical processes - pyrolysis (pyrolysis), catalytic and thermal reforming and design of equipment for the performance of these processes.

It is known knowledge that it is not expedient to construct units for thermal cracking and distillation having a capacity in the range of one million tons/year. It is necessary to turn towards the creation of units capable of processing from 6 to 8 million tons/year to provide raw material for the basic petrochemical processes.

Above all it refers to the steam cracking process.

For the recent two decades large-scale investigations on steam cracking of various kinds of hydrocarbon raw material had been performed by our researchers. The results of these studies were found wide practical application in the industry. In fact the cheapest gaseous raw material - overhead gases and oil processing gases, casing-head gasoline and naphtha - is processed by pyrolysis. About 50 thousand t/y of ethylene are obtained by steam cracking of medium and heavy oil distillates.

We have proved that in tube furnaces characterized by good gas formation and composition such products as kerosene, solar oil etc. can be processed by pyrolysis. There exists a definite trend in processing liquid pyrolysis products in our country. It is the present the light pyrolysis oil has been used for the production of components for engine motor fuels and solvents. Medium fractions, the so-called tarry oil, are directed to carbon black produc-

tion. The heavier liquid pyrolysis products are applied to obtain high-quality [illegible] coke, free of sulfur for the manufacture of [illegible] rods.

We have [illegible] new methods for processing the products: a new complex scheme for the utilization of the pyrolysis products has been elaborated.

As a result of the above investigations the technology has been elaborated to recover components of C_4 - fraction from pyrolysis products. These components are butene, divinyl - a - butenes (which are converted to divinyl through dehydrogenation), further cyclopentadiene isolated from the liquid pyrolysis products which proved to be a very important intermediate for the synthesis of highly efficient antiknock agent.

The unsaturated portion of liquid pyrolysis products is converted to [illegible] and at the same time most [illegible] materials through [illegible] by thermocatalytic polymerization.

In case of combination with organic polymerization peroxides solid diene and unsaturated aromatic hydrocarbons are formed.

After the removal of the bulk of unsaturated hydrocarbons the liquid pyrolysis products are hydrogenated and thermally treated to obtain benzene.

There is no doubt that in countries performing large-scale pyrolysis of liquid petroleum products by-products will become [illegible] sources of benzene.

At present [illegible] still remain the basic reactor devices. We have developed, elaborated the technol-

for steam cracking in a fluidized bed at a continuous flow permitting to process heavy stocks and to increase the unit capacities substantially. One of such pyrolysis units with an upstream heat carrier will be built at the beginning of the next five years.

We are speaking about pyrolysis processes not only as the supplier of the most basic produced intermediate for the modern organic synthesis – ethylene and its indispensable concomitant – propylene, but also as a source of unsaturated hydrocarbons C_4 and C_5 and highly aromatized fractions C_5 and higher. As a result of the pyrolysis of medium and heavy distillates a great amount of heavy tube oil is obtained.

The methods for ethylene and propylene recovery from pyrolysis gases are well known.

The American scientists have made a substantial contribution to the development of the technology for this process. The first in the Soviet Union unit for the recovery of ethylene and propylene from pyrolysis gases was designed in Azerbaijan.

The elaboration of the method for the production of high-purity ethylene and propylene was of especially great importance as determined the possibility to perform investigations into new trends of the organic synthesis and to develop new large tonnage processes for the production of polymeric and other valuable petrochemical products.

Important studies have been performed in Azerbaijan

aimed at creation, modernization and further development of the SK- industry. We note with satisfaction that the production of synthetic rubber, ethyl alcohol by sulfuric acid hydration of ethylene and direct formation of ethyl... were performed at the Sumgait, for the first time in the Soviet Union.

It should be mentioned that the development of the processes for the production of divinyl and isoprene on the basis of oil processing gases was to a certain degree associated with the investigations of Azerbaijan researchers widely elaborated processes performed in a fluidized catalyst bed and applied their technological processes of C_4 and C_5 hydrocarbon catalytic dehydrogenation.

For the last years these processes have been improved through oxidative hydrocarbon dehydrogenation bringing substantial changes in the technology of the production of divinyl, isoprene, styrene and other alkenyl- aroma tic hydrocarbons. The technology for the production of a new rather promising ethylene - propylene rubber is under development in Azerbaijan now.

Our scientists have accomplished interesting studies on oxidation and oxidative ammonolysis of hydrocarbons. For instance, production of acrolein from propylene, maleic anhydride from n- butylenes, phthalic anhydride from o- xylene, ethylene oxide by direct ethylene oxidation on a silver catalyst, propylene oxide in combination with obtaining alk-enyl- aromatic hydrocarbons through corresponding

hydroperoxides, plasticizers for polymers etc., acrylonitrile from propylene, methacrylonitrile from isobutene, phthalonitrils from xylenes.

The first large-scale acrylonitril unit based on the studies of our researchers is being constructed on an integrated chemical plant in our republic. The production of chloroorganic compounds proves to be one of the leading branches of petrochemistry in Azerbaijan. The application of a heat carrier fluidized bed has permitted to develop technology for the production of chlorine - substituted methane up to carbon tetrachloride, vinyl chloride etc. by one- stage chlorination. Our researchers' studies on oxidative hydrocarbon chlorination are of great practical interest.

Our scientists have carried out original studies on the synthesis of a number of other chloroorganic compounds on the basis of petroleum products which can be applied as plant protection agents.

Production of polymeric materials is a new important trend in the activities of the Azerbaijan scientists.

The results of the investigations into polymerization, oligomerization of alkenyl- aromatic hydrocarbons, their co-polymerization accompanied by restructuring of the hydrocarbon mass, free of unsaturated components.

Great efforts of our researchers have been made to develop an original technology of polystyrene production with new being commercially introduced in the near future.

Investigations into the synthesis of additives to lubricating oils are successfully being continued. This is a traditional sector of petrochemistry of Azerbaijan permitting to organize a special institute for additive chemistry.

It is worth mentioning that many additives formerly obtained to improve the lube oil properties proved to be very efficient stabilizing agents for polymeric materials, this being an impetus for a sharp increase in the scale of investigations in the field of synthesizing new stabilizers.

The unique nature of the base crudes, the presence of considerable amounts of naphthenic acids in them, the readiness of their recovery from petroleum products open up strong possibilities for synthesizing on the basis of these acids.

The plasticizers obtained by our scientists on the basis of naphthenic acids are rather efficient and substitute for products on the basis of deficient raw material of agricultural origin.

We also conduct investigations in the field of radiation chemistry and are seeking to find means of efficient affecting the latter in various petrochemical processes by high energy particles. We are going simply to extend the investigations in this direction in the years coming.

It is, naturally, difficult in a brief review to give a [illegible] problems our scientists are dealing with. The only thing I can do is to say that much attention has been paid to

solution of these problems in this Republic. It can be illustrated not only by the fact that scientific research institutes, a number of design organizations, chairs of higher educational establishments are involved in petrochemistry in this Republic.

More than 50 doctors of science and over 350 Academy of Science are operating on chemistry in our Republic. The outstanding scientists are Members of the Azerbaijan Academy of Science. In the establishment of this large scientific tremendous contribution was made by the Russian and Soviet scientists D.I.Mendeleev, V.V.Markovnikov, N.D.Zelinsky, S.V.Lebedev, A.E.Favorsky, L.A.Chugaev, A.E.Arbuzov, N.N.Semenov, I.A.Kirpichnikov, B.A.Kazansky, A.N.Arbuzov, M.I.Kabachnik, A.L.Petrov and others.

The names of the researchers M.G.Mamedaliev, V.A.Proskuryakova, M.F.Nagiev, N.P.Grigoriev, A.M.Guliev, V.B.Aliev, G.Sultanakhtiev and others, are well known greatly to the development of petrochemistry and to the establishment of the petrochemical industries of the USSR and Azerbaijan are famous far beyond the borders of our Republics.

Finally I would like to point out that the development of the petrochemical science and industry in Azerbaijan furnishes an excellent example to those countries which are encountering the problem of establishing and developing an up-to-date national industry, petrochemical industry, particular.

Training national cadres, establishment of national scientific centres should become one of the most important

aspects in the organization and development of a modern industry. It is especially important for developing countries to improve the people's well-being, to raise the scientific, technical and cultural level, to establish a modern economy. No particular emphasis is required to understand that processing of oil, especially petroleum processing results in increased [illegible] of the product by many times. It is not only the cost of product but that is to be taken into account. By establishing a petrochemical complex the country is provided with the necessary assortment of fuels, lubricating materials, products of organic synthesis. This approach offers [illegible] in the production of fertilizers and pesticides necessary for the use of culture.

[illegible] will enable the country to solve various problems in the field of social development, education, health protection, transportation, will contribute largely to the [illegible] economy development.

There is no doubt, that symposium, the broad exchange of opinions on problems of petrochemistry are beneficial for all the participants, for those from developing countries above all.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