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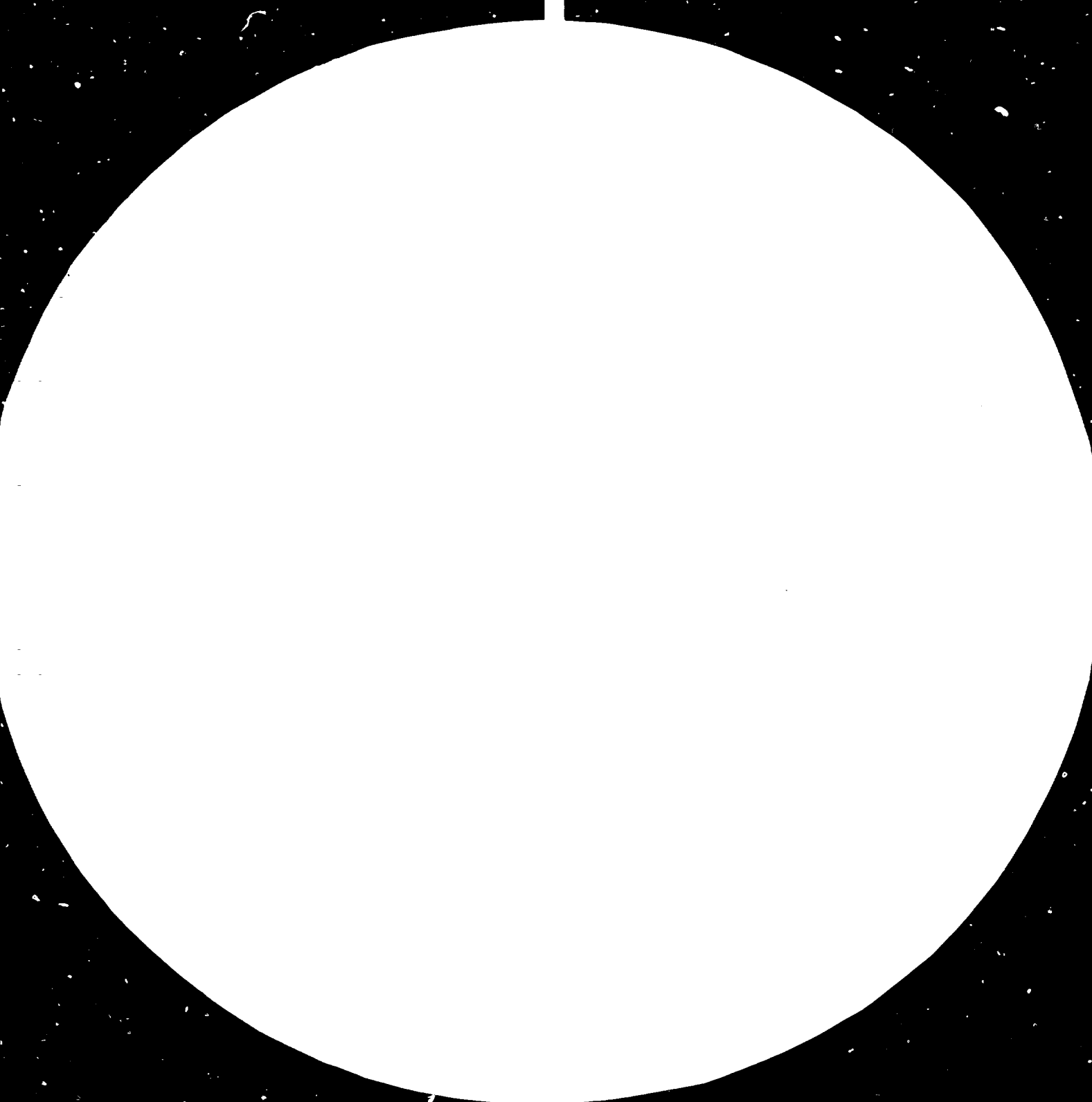

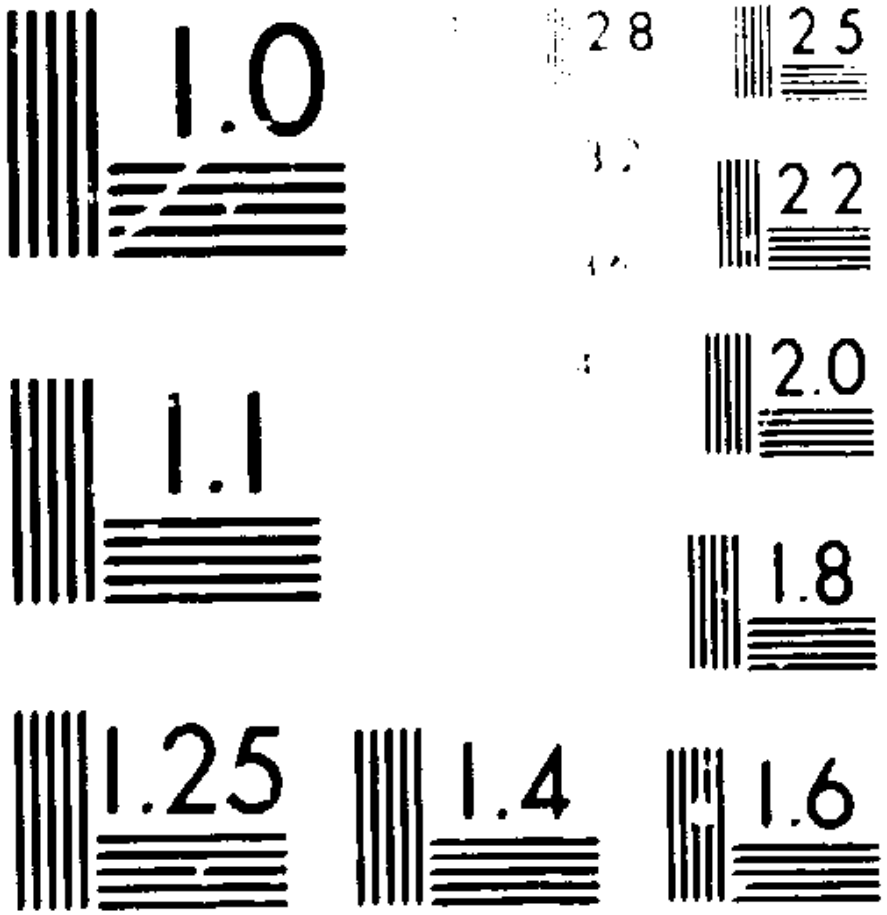
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THE CHEMICAL FERTILIZER INDUSTRY IN CHINA*

by

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Abstract

Since the founding of the People's Republic of China, the chemical fertilizer industry has been forging ahead at an average rate of 28.1% a year. At present there are more than 2200 enterprises engaged in the production of chemical fertilizers, with an annual output of over 12.30 million tons. In the production of chemical fertilizers, China has based her raw materials on domestic supply, manufactured through her own efforts complete sets of equipment, sulf- sufficiently has a surplus of various catalysts, and turned out a contigent of workers, engineers and technicians.

The paper sums up the five-point practice for the development at top speed of the chemical fertilizer industry in China: both central and local initiative have been brought into full display; simultaneous development of large-, medium-and small-sized plants have been carried out; large quantities of complete sets of equipment have been provided for the production of chemical fertilizers by various departments of the machinery industry; raw materials have always been used in line with local conditions, with coal predominating;

technical training has been organized to increase technical competence continuously; and the problem of supplying spare parts for the production equipment for chemical fertilizers and necessary industrial chemicals have been solved conscientiously.

The paper also points out the special features of the chemical fertilizer industry in China and its future trend.

I.

China has a population of 10 hundred million, accounting for one-fourth of the world total, but her area under cultivation amounts to only 7% of the total world arable land area. It is self-evident that she has to shoulder heavy responsibilities in developing her agriculture and feeding one-fourth of the world population with only 7% of the world arable land area. How to speed up the development of agriculture and raise the grain yield have always been an important subject under study, to which our country devotes much attention.

Our country has long been paying great attentions to the development of agriculture and giving it first priority in national economy.

In the early days after the establishment of the

People's Republic of China, the foundation of the chemical fertilizer industry was very weak, with only two nitrogenous fertilizer plants in operation in the whole country. The output of chemical fertilizers in 1949 registered only 5,700 tons, less than the present daily output, and there was only one kind of product, ammonium sulfate.

The number of large-, medium- and small-sized chemical fertilizer plants has now grown to more than 2,200, widely spread all over our country and found in every province, municipality and autonomous region. Among them there are over 1400 nitrogenous fertilizer plants and over 700 phosphatic fertilizer plants. The total output of chemical fertilizers in 1980 was over 12.30 million tons (calculated on the basis of N, P_2O_5 & K_2O, same for the followings) with about 10 million, 2.30 million and 20.000 tons of nitrogenous, phosphatic and potassic fertilizers respectively. From 1940 to 1980, the output of chemical fertilizers in China increased at an average annual growth rate of 28.1%. Based on the calculation of the chemical fertilizers produced domestically, the amount of fertilizers applied per mu increased from 0.0038kg(0.057kg/ha) during the initial post-liberation period to 8.2kg(123kg/ha) in 1980. More than 10 kinds of products have been produced; they are urea, ammonium nitrate, ammonium bicarbonate, ammonium chloride, aqueous ammonia, ammonium sulfate, single superphosphate, calcium magnesium phosphate, ammonium phosphates, potassium chloride, potassium sulfate, trace-element fertilizers, humate fertilizers, etc. China has based on her own

raw materials, self-made catalysts and plant equipments for the production of chemical fertilizers, and has cultivated a contingent of skilled workers, engineers and technicians. The chemical fertilizer industry in China has now grown into an industrial system fairly wide in scope, integrated with large-, medium- and small-sized plants rationally spread. Comparing with that of the initial post-liberation period, the physiognomy of chemical fertilizer industry has undergone radical changes.

Since the beginning of the seventies, in order to accelerate the expansion of our chemical fertilizer industry and to learn better foreign advanced techniques, China has imported thirteen 1000 T/D ammonia plants from abroad, using advanced technology. For the past few years, much work has been done on the operation and management of these imported plants, and good results have been obtained. Up to the end of 1980 the accumulative total of ammonia and urea produced in these plants reached 8.75 million and 13.58 million ton respectively, greatly contributing to agricultural production.

For more than two decades, over 1300 small nitrogenous fertilizer plants have been built, each producing 5,000 - 20,000 tons of ammonia annually. Their products are generally ranged in ammonium bicarbonate and aqueous ammonia. Only few plants produces ammonium chloride and ammonium nitrate. Nearly all the

small nitrogenous fertilizer plants use anthracite as raw material for the intermittent air-blown and steam gasification fixed-bed process with the exception of few plants which use natural gas or heavy oil. The plants have the advantages of rather short technological process, low investment, speedy erection and full utilization of scattered local coal resources. These small plants produced about 8.20 million tons of ammonia in 1980, accounting for approximately 55% of the total national ammonia output, and have become an important force in our chemical fertilizer industry. Ammonium bicarbonate readily decomposes, the loss can be reduced and the efficiency raised if air-tight packaging and deep placement are ensured. Generally speaking, heat utilization in these small plants is uneconomic due to their small size, consuming somewhat more energy than large- or medium-sized plants. However, if business administration is strengthened and waste heat is recovered and utilized, their energy consumption can be lowered. Some of our small plants using coal as the raw material have lowered their energy consumption, close to or even better than that of medium-sized plants.

Before liberation there was no phosphatic fertilizer industry in China, and it was not until 1955 that the commercial production of phosphatic fertilizers was started, with an annual output of merely 1,400 tons. More than one-third of our counties have small phos-

phatic fertilizer plants, producing more than 90% of the total. The products are mainly single superphosphate and calcium magnesium phosphate, with small quantities of basic slag, dicalcium phosphate, ammonium phosphates, nitro-phosphates, NPK complex fertilizers, etc.

The output of potassic fertilizers is very low, with an annual output of only 20,000-30,000 tons.

In order to accommodate the progress of agricultural production, China has also developed trace-element fertilizers in recent years. The principal products are boron, zinc, manganese, copper, molydenum fertilizers and others. Through field tests on crops and fruit trees, such as cotton, rape, etc. These fertilizers have shown remarkable effect on yield.

In addition to the development of mineral fertilizers, we have also paid attention to the expansion of organic chemical fertilizers. The products employed in trial-production in recent years, including humate and nitro-humate fertilizers, have played a role in ameliorating the soil, improving the fertilizer efficiency and stimulating crop growth.

Since the liberation of China, we have developed various catalysts for the production of chemical fertilizers with our own hands. Commercial production

began in 1953 with only two types of catalysts and an annual output of over 50 tons. At present there are altogether 15 types of catalysts with over 40 modifications and an annual output of approximately 2000 tons, which give us a surplus in self-sufficiency. Through their use in large-, medium- and small-sized nitrogenous fertilizer plants, satisfactory results are obtained.

II.

It is of primary importance that the following measures have been taken, through which the chemical fertilizer industry in China has made such great achievements:

1. Bringing both initiatives of national and local enterprises into full play and carrying out the policy of simultaneous development of small-, medium and large-sized plants:

In China, the governments at different levels always pay much attention to the chemical fertilizer industry, because agriculture, being the direct consumer of chemical fertilizers, is the basis of the national economy. The Ministry of Chemical Industry, being in charge of the chemical fertilizer industry, always puts special stress on the production and development of chemical fertilizers and makes all the necessary arrangements to fulfil these tasks. Since the

founding of the People's Republic of China, more than half of the total investment for the chemical industry has been made in chemical fertilizers. The construction of large and medium nitrogenous fertilizer plants, which calls for larger investment, and requires more sophisticated techniques in the manufacture of equipment, is invested with funds, manpower and materials allocated by the state. Besides, the construction of small-sized chemical fertilizer plants, which calls for less investment and requires only easily made equipment is therefore invested by local governments.

Relatively rapid progress has been achieved in chemical fertilizer industry, as a result of bringing both the initiatives of central and local authorities into full play and upholding the policy of developing large-, medium- and small-sized plants simultaneously.

2. <u>A lot of complete sets of equipment for chemical fertilizer production are supplied by departments of the machinery industry:</u>

As is well known, since the production of chemical fertilizers especially nitrogenous fertilizers, has to be carried out under high-temperature, high-pressure, inflammable, explosive, poisonous and corrosive conditions, the requirements for the manufacturing technique and materials of the equipment are rather strict, particularly with large ammonia units.

The development of the chemical fertilizer industry depends on the timely supply of complete sets of equipment which can hardly be managed by local authorities. Mass-production of such equipment has been consolidated by our departments of machinery industry, among them over 30 ammonia installations, each with a daily capacity of 200 tons, have been turned out. To give an impetus to the development of small-sized nitrogenous fertilizer plants, more than 700 complete sets of equipment for small-sized nitrogenous fertilizer plants were provided by the machinery and electrical industries in Shanghai in the last ten years or more. At present, we able to design, fabricate and install ammonia units scaling from 10,000, 50,000 to 150,000 tons NH_3/year and the respective ammonia processing plants.

3. Using raw materials according to local resources, and putting special stress on coal:

The chemical fertilizer industry is a processing industry, the speed of its progress depending to a great extent on the supply of raw materials, so we have always put stress on the importance of supplying raw materials for the production of ammonia. Undoubtedly, taking natural gas and oil as raw material for ammonia is better than using coal, nevertheless, our output of natural gas and petroleum is still not high enough, as against our abundant coal reserve. For the reason of keeping our footing on domestic resources, we must fol-

low the policy of stressing on coal while increasing oil and natural gas supplies. In 1970 over 90% of the ammonia produced was based on coal and coke. In the last decade, in spite of the fact that the weight of oil and gas in ammonia feedstocks as a whole was increased due to the exploitation of petroleum and natural gas, yet over 65% of the total ammonia output was still based on coal and coke. The plants based on anthracite in our country are mainly small- and medium-sized ones; large-sized ammonia plants use natural gas and naphtha as raw materials. It should be particularly pointed out that due to inadequate supply of lump anthracite, our small plants have adopted the methods of processing powdered anthracite into briquettes for the manufacture of ammonia, among them, the method of carbonating coal briquettes is the most popular one. Carbonated coal briquettes have the advantages of good thermal stability, high ash fusion point, low fluid flow resistance and high reactivity, and hence they are extensively used in small plants. The number of plants using carbonated coal briquettes has now exceeded 700. By accomodating measures to local conditions, our synthetic ammonia industry opens up all sources of raw materials, ensuring the normal production of ammonia and promoting vigorously the growth of the chemical fertilizer industry.

4. Organizing technical training courses heighten constantly our personnel technical capabilities;

The production of chemical fertilizers, and especially that of nitrogenous fertilizers, requires high-level techniques and its success depends not only on equipment and raw materials but also on the technical and management competence of workers, engineers, technicians and administrative cadres; therefore we have long stressed that technical training be regarded as a daily routine work. Before commissioning a plant, we usually organize workers, engineers, technicians and administrative cadres to go for practising in a running plant of the same type for more than six months, and only when they are deemed qualified after an assessment of their technical proficiencies can they be allowed to operate alone in a newly commissioned plant. Afterwards they will still study regularly in organized groups to improve further their efficiency in operation and management, thus ensuring normal production. Due to our emphasis on technical training, not only is the normal production of medium- and small-sized plants ensured, but also is the technology of the large plants mastered quickly. Owing to ever persisting in taking the road of strengthening technical training of the staff and personnel, and raising uninterruptedly the level of scientific management, the staff and workers of the Sichuan Chemical Plant were able to coordinate their actions in running the large-sized plant continuously for 379 days and resulting in significant economical benefits.

5. <u>To deal seriously with the problem of supplying spare parts for the production equipment and necessary industrial chemicals</u>:

In addition to the reliable equipment, sufficient raw materials, operators and administrative cadres of high technical proficiency, we should also have an ample supply of spare parts and industrial chemicals necessary to the production of chemical fertilizers, so that continous and steady production of chemical fertilizers can be carried out.

Our solution to the problem is to subject it under the supervision at two levels, centrally and locally. As to large and medium plants, the spare parts, being big and hard to make, demand a high standard of fabricating technique, so that they are provided by the Ministry of Chemical Industry under unified planning; those for small plants are rather easy to make and hence usually furnished by local-owned enterprises. The provinces with more small plants often have a chemical machinery factory in every prefecture, specialized in the supply of spare parts for the small plants. For example, in the province of Shandong there are now over 120 small-sized nitrogenous fertilizer plants, with a chemical machinery factory in each of the nine prefectures, serving mainly the small plants in the province. Thus, national and local enterprises share out the works and cooperate with one another, so the supply of spare parts and normal operation of the plants are gua-

ranteed.

The industrial chemicals needed for the production of chemical fertilizers, such as amino acetic acid, hydroquinone, ethanolamine, sulfolane, sodium anthraquinone disulfonate, etc., are produced under unified planning and their supply is therefore ensured.

By taking these measures, plant design, fabrication of equipment, installation and production and provision of catalysts, spare parts and industrial chemicals for the chemical fertilizer industry are mostly done at home and by ourselves. Moreover, a number of large nitrogenous fertilizer plants using advanced technology were introduced into our country in the seventies. Hence, the continuous and steady development of our chemical fertilizer industry is assured.

III.

Although our chemical fertilizer industry has already made great strides forward, yet the amount, variety and quality of the fertilizers produced cannot meet the needs of agricultural production. The progress of phosphatic and potassic fertilizers is low. The fertilizer products are mostly straight ones, with little complex or mixed fertilizers.

At present, the chemical fertilizer industry of our country is implementing the policy of "readjustment, restructure, consolidation and improvement". The production of phosphatic and potassic fertilizers is planned to be further stepped up in the future, and their weights in the whole chemical fertilizer productions will be increased. Major efforts will be devoted to the development of high-analysis complex or mixed fertilizers and scientific application of fertilizers. Technical management will be further strengthened and operating skill improved. Energy constumption has to be further lowered through technical reform. More stress will be laid on scientific research to open up new technique and technology. We firmly believe that our chemical fertilizer industry will push ahead more steadily and coordiantely through readjustment, making a greater contribution to the speedy expansion of agriculture.