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Research on Health Effects of Environmental Chemicals Based on Structure and Gene Association Analysis

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Abstract: China is a major producer and consumer of chemicals. The production and use of chemicals play a role in the development of the entire national economy. Therefore, effective chemical management has a huge impact on the development of the national economy. At present, chemical management guidelines have achieved a lot in chemical operations, but there are still many shortcomings. Relevant institutions should further improve the standard system, strengthen the coordination of subjective institutions, the supervision and management, establish information standards, complete information sharing, build a feedback system, strengthen the transformation of experimental results and trust training.

Keywords: Structure; Genes; Association Analysis; Chemicals; Health Effects

China is a major producer and consumer of chemicals. The production and use of chemicals is already China's major feature. There are many varieties, which are related to the development of the national economy. The establishment of relationship models is usually based on the unity of toxicological effects of the modeled samples; however, in fact, the complex health effects of fertility, endocrine and other systems are usually not mediated by single target function or single function genes. Instead, by changing a set of gene functions, regulating the Zheng Ge gene network causes changes in the body's health. Therefore, some chemical products with very different chemical structures also have similar health effects, resulting in a low efficiency in estimating health and toxicological effects through chemical structures[1].

1. Development trends of chemical management guidelines

Although China has established a chemical control standard system, there are still many loopholes, and chemical management standardization needs to be improved.

1.1 Criteria of chemical risk assessment

Chemical risk assessment is the main technology model for chemical risk management and control. China has introduced the management concept of risk assessment. In 2010, the Ministry of Environmental Protection promulgated and implemented the "Measures for the Management of New Chemical Substances", advocating for changes in the management and control of new chemical substances from hazards to risk assessments. The assessment report is also included in the information required for the general application of new chemical substances. The "Regulations on the Safety Management of Dangerous Chemicals" promulgated by the State Council in 2011 also clearly stated that the supervision of ecological hazards of hazardous chemicals and the evaluation of natural risks should also be included. In view of the increasingly stringent assessment criteria proposed by the chemical control work for risk assessment, it provides technical support for the implementation of the corresponding legal system[2].

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2. Standardization of chemical evaluation conditions

China has converted and absorbed a large number of global universal testing model guidelines and developed self-innovative testing guidelines. Conditional factors such as animals and the testing environment have played a key role in the implementation of these guidelines. At present, China lacks relevant standards for toxicological tests, which has a predetermined degree of influence on the global mutual recognition of experimental parameters. The test conditions in China is still in the process of standardization, and the testing environment will be further standardized to promote the global recognition of test parameters[3].

3. Criteria for emergency response to chemical incidents

Chemical problems have occurred frequently in recent years. For example, the poisoned email incident of employees in the logistics industry and the "Shanxi Extraordinary Phenol Leakage" in the environmental protection industry caused great damage to people's lives and property. Compared with other incidents, chemical incidents are more harmful. So how to minimize the impact and damage caused by chemical incidents should be valued by society as a whole[4]. China has accumulated some research experience and specific methods for emergency response to chemical incidents, but has not issued relevant guidelines. Emergency response modes for chemical incidents need to be improved.

4. Technical guidelines for chemical risk analysis

Global research on chemical control continues to ferment, and the United Nations has also set up relevant forums. Civil administration's understanding of chemicals and their effects is still in the initial period. At present, human experimental parameters of chemicals are less than 1/3, and animal welfare is also valued by the public. Research on chemical risk analysis technology is still continuing. Research on scientific and technological guidelines of chemical risk analysis will be more inclined to experiments with animals[5].

5. Research analysis

The research in this paper uses hundreds of environmental chemicals in the public parameter database and more than 1000 types of gene/target network parameters controlled by it. By use of big data, this paper explores analytical models and construct multiple types of chemical structures with health effects as the hub. Correlation components of characteristics and gene/target parameters reveal the differences in chemical structure and regulatory genes, channels, and biological networks on human health and differences in corresponding diseases. Figure 1 shows the chemical structure and characteristic gene networks related to various health effects. The chemical structural characteristics of a certain type of health are unique and complicated, and correspondingly, the associated genes/targets have some obvious collections in the network and never overlapped nodes[6]. For example, the health effects associated with hepatomegaly are characterized by changes in the gene expression of the P450 family of cellular elements such as CYP1A1 and CYP1A2, and the characteristic genes are collected in the replacement of exogenous chemical objects with cytochrome P450 and arachidonic acid Metabolism and other channels affect the metabolism of exogenous substances and liver lipid synthesis. Its chemical common point is that most of the fragments have 2-propanol-like characteristics, but the actual mechanism will be different due to differences in chemical structure. For example, TCDD, etc., can be fused with AhR to adjust the expression of genes such as CYP1A1. In addition, the up-regulation of gene expression such as CYP1A1 can also be changed directly after entering cells. For another example, aflatoxin B1, and its metabolic products aflatoxin Q1 and aflatoxin M1, are activated by cytochrome P450 in the viscera, constituting an intermediate of cytotoxicity and DNA reaction, and causing pain in viscera and other diseases such as liver enlargement[7].

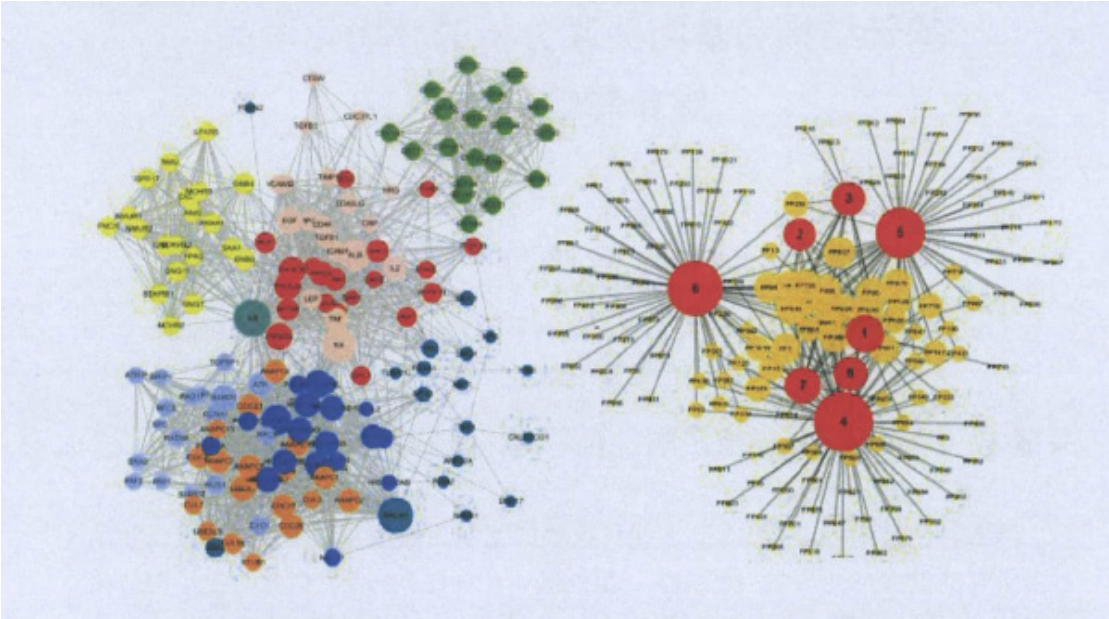

Figure 1. Health impact elements under various chemical structures and characteristics.

6. The key strategy of hazardous chemical safety management

6.1 Environmental level

At the level of the use, storage, and safety management of hazardous chemicals, environmental factors are indispensable. Chemicals have various special characteristics, which can be greatly affected by temperature, closed conditions, and humidity. Therefore, chemical plants should store and classify chemical products in accordance with the standards for the storage of chemicals, so as to provide them with corresponding savings places. For example, some hazardous chemicals storage sites must clearly indicate that fireworks are strictly prohibited, and emergency treatment strategies, such as fire extinguishing equipment, must be provided nearby. Second, chemically compressed gaseous materials with explosive characteristics should be excluded according to the safety status of the cylinders to avoid the formation of safety risks. In addition, volatile materials must be stored strictly in accordance with the use and storage guidelines in an air-ventilated place. Moreover, because some chemicals will react chemically when they are wet, they should be stored in dry place with low humidity[8].

6.2 Artificial level

The manual level is a key content in the safety management of hazardous chemicals, and its efficiency is extremely important. Therefore, in the implementation of specific safety management and control phases, plant management personnel must deeply realize the importance of chemical safety management and control, perform their duties and interpret the contents about workplaces such as the production, use and storage of hazardous chemicals in factories. Second, safety management and control managers should pay attention to the training of the professional level, safety capabilities and safety system of the remaining control personnel, and strictly follow the "Dangerous Chemicals Safety Management Regulations" to integrate the specific production conditions of chemical plants and draft rules and regulations. Furthermore, the safety of such sections as the purchase, transportation, storage and operation of hazardous chemicals is guaranteed. Additionally, relevant managers of chemical plants should pay attention to strengthening the strict inspection of the use and production of dangerous chemicals. Generally, the corresponding reward and punishment system can restrain employees, so as to reduce the risk generation rate to a certain degree.

6.3 Disposal of hazardous chemicals in chemical plants

In the management stage of specific hazardous chemicals, the implementation of efficient and reasonable management of hazardous chemical wastes is also one of the main points of management. Therefore, after using hazardous chemicals, personnel concerned should pay attention to the efficient and reasonable discharge of them, and

dispose of the waste water and waste gas in the test process, so that they can be discharged after meeting the clear discharge standards; second, in the specific stage of production of hazardous chemicals, employees must implement classified storage to prevent adverse chemical reactions caused by confusion with other chemicals[9]. In addition, chemicals with toxicological characteristics should be centrally coded, and efficient disposal should be implemented through environmental protection agencies. Meanwhile, all employees in the chemical plant must keep in mind that the waste chemicals in the experiment cannot be randomly deposited, nor can they be directly disposed of once, and the corresponding disposal mode should be adopted immediately after production.

6.4 Institutional level

At present, there are still some loopholes in the safety management system for most hazardous chemicals in chemical plants, which causes various safety problems. This poses a set threat to the safety of people's lives to a certain degree. Therefore, it is necessary to build a complete, efficient and scientific safety management and control system for chemical plant, for example, implementing the production safety responsibility system of various production safety agencies, clarifying the safety responsibilities of managers and units, building a reward and punishment system for production safety, a system for the integration and elimination of safety concerns, and a training system for factory production staff, safety education and professional evaluation. The control system and the anti-explosion and fire control in the production area of the chemical plant are extremely critical. Secondly, relevant factory managers should pay attention to the construction of a special production system for special chemicals, thus further reducing the potential safety hazards of hazardous chemicals to a great extent. In addition, the Chinese government must effectively implement safety management of the hazardous chemicals and control of all relevant enterprises. Involved departments include environmental protection authorities, quality supervision and inspection agencies, and safety production supervision agencies. In addition, the enforcement of relevant legal regulations should be strengthened, and the safety management and control of relevant chemical companies must be monitored and evaluated to ensure that the risks of hazardous chemicals are controlled to the minimum standards[10]. Meanwhile, relevant institutions must establish and improve systems, and actively establish a good scheduling relationship with various institutions, while chemical plants must comply with relevant legal regulations and actively cooperate with government agencies in the safety management and control stage.

7. Conclusion

Summarily, in the stage of safety management and control of hazardous chemicals, chemical plants should pay attention to discovering and resolving problems, and integrate specific conditions to formulate targeted scientific and legal corresponding strategies. In specific management, relevant chemical plant managers should focus on the professional knowledge training and overall quality training of employees to prevent hazardous chemicals from becoming a social disaster.

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