Pollutants' discharges and capacities: a comprehensive understanding for pollution sources and aquatic environmental medium is needed in China

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In the last 20 years, especially since 2000, great efforts have been made in China to prevent the aquatic environment from being worsened and to improve the quality of surface water. Much manpower, material resources have been put and a large number of major research projects have been approved related to the aquatic environmental improvement. A group of national water pollution control and management technology major projects of China were approved in 2006 for the 11th 5-year development plan, in 2011 those projects for the 12th 5-year development plan were granted, and those for the 13th 5-year development plan is about to be initiated this year (MEP 2016). In addition, there is a group of public welfare projects of Ministry of Environmental Protection approved in China once every year since 2006 (MEP 2015). From the research contents listed in these projects, researchers have mainly focused on the technologies on the terminal treatment of sewage and ecological restoration of polluted aquatic environment, which have been transferred to be a series of effective practical measures. However, rivers and lakes in China are generally subject to various degrees of pollution, and in recent years, there is almost no improvement in such a large input. This will not only threat people's health but also be a major obstacle to the sustainability of China, including national economy and society.

Research projects in China mostly made efforts in sewage treatment and ecological restoration of aquatic environment,

which reflected the way of pollution first in aquatic environmental management. However, pollutants' discharges of pollution sources and the pollutants' capacities of aquatic environmental medium, which represent the policy of putting prevention first, have both been ignored for a long time in China. It is the most basic work to understand the sources of pollution and pollutants' carrying capacities of aquatic environmental medium to prevent the aquatic environment from being overexploited. The two aspects respectively correspond to the process of waste discharge and the waste disposal of the nature. If the former is greater than the latter, the quality of the aquatic environment would be deteriorated; conversely, it would be improved.

The census of pollution sources has begun in China since 2007 and the information is updated once every 5 years (MEP 2007). In the census, the rough information on pollution sources and such conventional pollutants discharged have been generally identified as chemical oxygen demand and ammonia nitrogen all over the nation. Totally, more than 30 indexes have been basically made clear including the pollution sources' name, the location of the sources, and the total amount of pollutants discharged annually. Compared with previous environmental management mode, the implementation of this census could be a great improvement. According to the census, detailed information has been acquired on the locations and addresses of enterprises or wastewater treatment plants. However, seldom are the indicators on pollutions sources gathered concerned about the discharging process and "the total amount of pollutants discharged annually" is the only indicator used to illustrate the pollutants' discharging of the sources. The data obtained in the census is not enough to analyze the characteristics on the temporal and spatial distribution of the total amounts, the concentrations, and the composition of the pollutants discharged.

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The pollutants' capacity of aquatic environmental medium is the maximum amount of the pollutant which could be self-purified in one river or lake under the premise of keeping human and nature healthy of the region. It was once a heated discussion and an issue arousing wide concern (Liang et al. 2015). However, just as Jining Chen, the minister of environmental protection, said at a press conference of the third session of the 12th National People's Congress that the reliable data are still absent on environmental capacities in China (CCTV 2015). To both environmental managers and researchers, it is not clear how much and what kind of pollutants could be discharged into the rivers or lakes in China. The reason for this is that the calculation and modeling process on environmental capacities need detailed fundamental information of environmental medium, including the hydrological information of the water bodies, such as the data with high temporal and spatial density on flow, velocity and flow direction, channel morphology, surface runoff, and the boundary condition of the water quality with high temporal and spatial density. It is difficult for one research team, or even one university or research institute, to obtain sufficient data on environmental capacities' calculation and they can only individually get some rough data on this purpose. Under the current scientific research system in China, these basic data are difficult to be shared among different agencies. This results in the absent of relevant data almost in all environmental capacities' calculation of various areas and basins, and then, it is no way of talking about controlling the discharge of pollutants which should be identified by the pollutants' capacities of aquatic environmental medium.

Thus, what is needed in China is a comprehensive understanding of both the pollutants' discharges of pollution sources and the pollutants' capacities of aquatic environmental medium. First, a detailed investigation on pollution sources should be carried out. The discharging characteristics of each pollution source should be elaborately understood, including the composition of pollutants in sewage, the detailed time distribution of pollutants' emissions, and the outfalls along the river. The specific contents of pollution sources' deep insight might be different among various types of pollution sources. Besides the information mentioned above, data of industrial pollution sources should include the main product categories, yield, total output value, the number of employees, the types, the consumption and quota of raw materials and water, their production process, and main equipment and apparatus. Information of domestic pollution sources should additionally include such items as population, the status of water supply system and sewage discharging system,

and the consumption of water per person. Then, the archives of various types of pollution sources are established and the evaluation criteria could be selected on the basis of sources' comprehensive analysis. Thus, the potential risk of the various sources to the aquatic environment could be estimated and determined.

Besides, it is necessary to carry out by the government a large-scale and detailed observation on the relevant basic data in environmental capacities' calculation on the basis of the integration of the observed information of various research institutes. Such questions can all be answered by the pollutants' capacities of aquatic environmental medium as follows: what types of pollutants the rivers in the basin or region can be digested in the condition of ensuring their self purification capacities, how much sewage each outfall can accommodate, and what the temporal and seasonal distribution of the discharge of each source should be.

Consequently, information of pollutants' capacities of aquatic environmental medium and pollutants' discharge of pollution sources could be combined so as to put forward the controlling countermeasures and suggestions on pollutants' discharges, composition, temporal, and spatial distributions of pollutants' load on the regional level; thus, the goal of improving the quality of aquatic environment might be achieved.

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Compliance with ethical standards

Conflict of interest The author declares that she has no competing interests.

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