Solving Waste Lead-acid Battery Problems in China: Risk and Challenges

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Since these were produced in scale in the 1980s, lead-acid batteries (LABs) have been extensively applied in automobile, ships, power engineering, communication and other fields. Its relatively large power-to-weight ratio, low cost and easy recyclability make these attractive for use in energy storage today (Tian et al., 2015; Lin and Qiu, 2011; Maruthamuthu et al., 2011; Zhang et al., 2016). The global lead acid battery market size has been valued at 42.9 billion USD in 2017, and is expected to witness growth, owing to its increasing usage in vehicles and uninterruptible power system (UPS) (Grand View Research, 2017). Although it may cause environmental pollution problems after discarding, there is no better alternative in the short term. The average service life of LABs is approximately two years (Hsiao et al., 2014). These booming industries resulted in a large amount of waste LABs in China.

In general, LABs are environmentally friendly, and do not emit pollutants during use. However, these cause serious pollution during recycling and regeneration (as seen in Fig.1). Waste LABs are one of the 49 categories of hazardous waste released by the state (MEP, 2016). Waste LABs, including heavy metals and sulfuric acid, can seriously pollute the environment, especially the soil and water (Daniel et al., 2003). Waste LABs recycling in developing countries is an industry chain processes which are carried out in the informal economy. Waste LABs recycling activeties in the informal sector are carried out by a series of legal, unregistered and publicly accepted enterprises who give little concern to illegal executed processs which have a great impact on the environment and human health.

Before 2010, the lead acid battery industry was in a state of freedom and disorder in China due to the lack of industrial guidance. As a result, rapid development brought many problems, such as low industrial concentration, environmental pollution, energy waste, overcapacity and indifference in social responsibility. Lead pollution is becoming more and more serious in China, and lead pollution incidents have frequently occurred, which led to a series of social events. Since 2010, the state has introduced a series of lead industry-related policies and standards, which would guide in the healthy development of industries from development planning and industry access to pollution prevention and control. Nevertheless, existing laws and policies often have poor performance in operation, and have difficulties in dealing with specific problems in practical work.

At least two problems are limiting the Orderliness and sustainability of final disposal of waste LABs: one is that a large number of waste LABs is entering illegal channels, and the other is potential environmental and health risk. Increasing production of secondary lead has revealed that china's waste LABs is the global issue. Nevertheless, waste LABs management in China is still in its infancy. There is no overall paper to elaborate China’s waste LABs management. Basically, exploring feasible solutions to this issue requires a comprehensive analysis of national and local regulations on environmental pollution and other hazards caused by waste LABs recycling. In order to develop a comprehensive management scheme for waste LABs in China, firstly this work has investigated the generation and distribution of waste LABs, and systematically summarized waste LABs issues in terms of environmental health risk and resource recycling. Then we analysed the status and existing problems of current policies, collection systems and recycling procedures. With the objective of responding some of the problems and challenges, we propose some substantial solutions for improving waste LABs

management in the future. First, it is necessary to draw lessons from foreign experience and formulate some implementation rules. In particular, local governments and relevant administrative departments should gradually formulate local management measures in accordance with local conditions, relying on existing laws and regulations. At the same time, the government must make some strategic decisions to strengthen legislation and law enforcement, in order to standardize the recovery and utilization of spent LABs. Second, the scarcity of collection systems is the biggest obstacle for disposaling waste LABs, so if we want to fundamentally eliminate the illegal dismantling of waste LABs in a small factory, the Ministry of Environmental Protection (MEP) should establish a safe and effective waste LAB recycling system that covers the whole country, rather than relying on enterprises to establish their own recycling system through the "Extended Producer Responsibility", since the "recycling system" established by the enterprise is based on its own production benefits, and the "recycling system" established by MEP is based on environmental protection and ecological civilization.

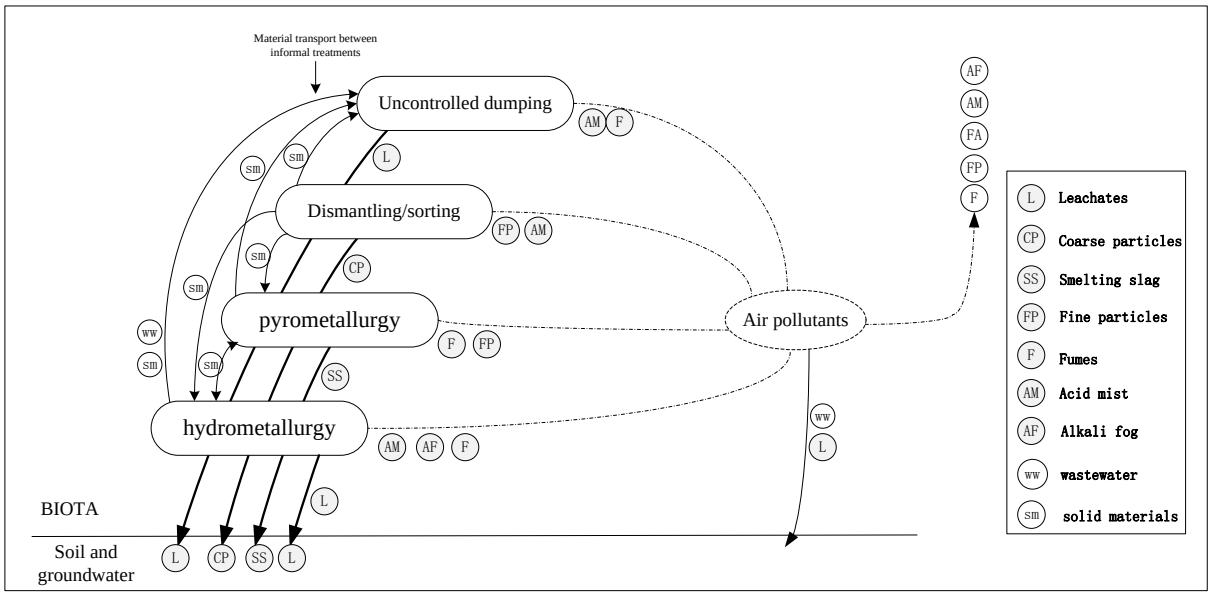

Figure 1 Pollutants and general environmental pathways from informal waste LABs recycling activities in China

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