



How Communities Can Respond to Mask Contamination in the Post-Epidemic Era

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Abstract. Since the outbreak of the epidemic, masks have effectively prevented the spread of viruses and other diseases. The main components of disposable masks we use are polypropylene and polyethylene. Abandoned masks can have serious impacts on society, the environment, and humanity. With the normalization of epidemic prevention and control, masks are still an indispensable epidemic prevention item in people's lives in the post epidemic era. The "new pollution" caused by discarded masks should be of concern to the government, society, experts, and more people. Preventing and eliminating the "new pollution" caused by disposable masks has become an urgent problem that the government and society need to solve. This article analyzes the current situation of mask pollution, conducts a comprehensive survey and model analysis through a community resident network survey questionnaire, and proposes countermeasures for the standardized disposal of discarded masks in the community to eliminate the pollution and harm caused by discarded masks.

Keywords: Epidemic; Abandoned masks; Pollution; community.

1 Introduction

The New Crown outbreak broke out in our country in late December 2019 and then spread rapidly across the globe. Since the outbreak, masks have effectively stopped the spread of the virus and other diseases. The disposable masks we currently use generally have three layers, the inner and outer layers are non-woven fabrics, which can play the role of filtration, and the middle layer is melt-blown fabric. In terms of material, the main components are polypropylene and polyethylene, which are often referred to as plastic. Approximately 75% of used masks end up in landfills or water bodies, and if the disposal of these wastes is not managed correctly, there may be a risk of secondary transmission of outbreaks [1]. Masks going directly to landfills may generate large amounts of micro-plastics in groundwater and soil. Micro-plastics have a huge negative impact on ecosystems, they contaminate freshwater and coastal environments and cause harm to plants and animals in aquatic environments such as ulcers, reproductive disorders, death from oxidative stress, reduced growth and feeding rates, and acting as vectors for other contaminants [2]. We are also exposed to micro-plastics through the food chain and the concentration of micro-plastics in the human body may increase through bio-accumulation, which can lead to serious health problems. It takes more than 500 years for discarded masks to naturally degrade, and if left untreated they will remain in nature for hundreds of years [3]. With the normalization of epidemic prevention and control, masks are still indispensable epidemic prevention items in people's lives in the post epidemic era, the "new pollution" caused by discarded masks should be concerned by the government, society, experts and more people, to prevent and eliminate the "new pollution" generated by disposable masks. The prevention and elimination of the "new pollution" caused by disposable masks has become a problem that needs to be solved by the government and the society [4]. In this paper, we will focus on how to standardize the disposal of discarded masks in the community, to eliminate the pollution caused by masks and to protect our homes.

2 Literature review

2.1 Current status of mask contamination

Prata J C, Silva A L P, Walker T R, Masks continue to be an essential part of everyday life as outbreaks become more normalized, but their "disposable" nature continues to increase the amount of masks discarded at a rapid rate. Studies estimate that a staggering 129 billion masks are used globally each month (3 million per minute), the majority of which are disposable masks made from polypropylene microfibers, according to Fadare O O, Okoffo E D. Disposable masks are being used on a scale almost similar to that of plastic bottles. However, unlike plastic bottles, there are no official guidelines for recycling of masks, and disposable masks are more

likely to be disposed of as solid waste in landfills and incinerators. Andradý A L argues that disposable masks, once in the environment, are exposed to solar radiation and heat and begin to decompose, but that polypropylene degrades very slowly, due to its high hydrophobicity, high molecular weight, scarcity of reactive functional groups, and its chain structure consisting of repetitive methylene units. However, due to the high hydrophobicity of polypropylene, its high molecular weight, its lack of reactive functional groups and its chain structure consisting of repeating methylene units, polypropylene degrades very slowly. If not collected and managed properly, the masks may be transported from land to freshwater and marine environments via surface runoff, rivers, ocean currents, wind and animals. Like other plastic debris, disposable masks can accumulate and release harmful chemical and biological substances. As a result of the New Crown Pneumonia epidemic, the global production demand for disposable masks is approximately 3.4 billion per day. Yet on average, each mask requires approximately 10-30 Wh of energy to produce, and each disposable mask releases 59 grams of carbon dioxide greenhouse gases during the production, packaging, and transportation stages. The large amount of carbon dioxide emitted during the production of these masks may contribute to global warming trends, and the masks are mainly made of non-renewable petroleum-based polymer materials. About 75% of used masks end up in landfills or bodies of water, and if this waste is not disposed of correctly, discarded masks pose a risk of secondary transmission of epidemics. Silva A L P, et al. point out that direct land-filling of masks may generate large amounts of micro-plastics in groundwater and soil. Micro-plastics have a huge negative impact on the ecosystem, they contaminate freshwater and coastal environments and cause harm to plants and animals in aquatic environments such as ulcers, reproductive disorders, death from oxidative stress, reduced growth and feeding rates, and become vectors for other pollutants. We are also exposed to micro-plastics through the food chain, and concentrations of micro-plastics in the human body may increase through bio-accumulation, which can lead to serious health problems. Plastic materials take much longer to break down, and if left untreated, they remain in nature for centuries. Li Xiaoqing, Wang Jiakui believes that with the development of mask production lines, China's mask production capacity is rising, since the past five years China's entire mask production and output value rose year by year, in 2019 China's mask production reached 5 billion, the growth rate of 10.13%. The outbreak of the epidemic makes China's mask demand blowout outbreak, as of February 10, 2020, the mask enterprise resumption rate of 76%, mask production capacity of about 16 million. Under normal circumstances, China's daily production capacity of masks is 20 million, medical surgical masks up to 2.2 million, N95 masks up to 600,000 only. However, with the massive increase in the production of masks, improper handling of masks has caused a series of social problems, secondary infections and environmental pollution problems have surfaced. There have been a large number of reports pointing out that a large number of discarded masks are swallowed into the stomachs of small animals at sea or entangled in their limbs to restrict their movements, which will eventually lead to their deaths [5].

2.2 Ways to address mask contamination

According to Bujak J W, incineration can not only treat waste plastics on a large scale, but also recover heat energy and realize the resource utilization of waste. Uekert T et al. pointed out that the main products of PP filter layer incineration are carbon dioxide and water, but due to the variations in the other plastic components in the disposable masks, incineration temperatures, and the amount of oxygen, etc., it can also produce toxic compounds of poly-cyclic aromatic hydrocarbons (PAHs), carbon monoxide, and dioxins. Harmful substances. Therefore, incineration is not an ideal way to dispose of waste plastics as it requires a complete system of pollutant treatment and decontamination. Maris J et al. concluded that because of the intolerance of bacteria and viruses to high temperatures, the use of high-temperature mechanical co-compounding recycling is an effective way to recycle discarded disposable masks while ensuring that workers do not come into direct contact with unsterilized disposable masks. Mechanical recycling is the process of reprocessing plastic solid waste. Processing plastic solid waste through mechanical recycling is one of the most economical, widely used and eco-efficient ways to recycle waste. The main principle of mechanical recycling is the remodeling of plastic materials. Waste plastics are re-pelletized and then sold on the market in the form of grocery bags, blinds, and other household products. In practice, the recycling process cannot completely transform all plastic waste into another new reusable product, and there is bound to be a loss of quality in the recycling process. According to Ningning Lu, the recycling and flame-retardant modification of disposable mask filter layer materials due to the heat-intolerant nature of the bacteria and viruses in disposable masks, the use of high-temperature mechanical co-mingling to recycle discarded disposable mask materials, which endows the recycled materials with better mechanical properties and additional flame-retardant properties, explores a new way and method to recycle the filter layer (FL) materials of masks. Peiwen He combined the low energy consumption and pollution-free electrostatic spinning process, by adding high-performance antimicrobial agents into the spinning stock solution, the killing ability of the filter material against germs was significantly enhanced under the premise of ensuring that the material has high-efficiency and low-resistance filtration performance, which greatly enhances the prospect of its application in the filter material for protective masks. Based on degradable PLA raw material, Wang Ling used electrostatic spinning process to prepare degradable high efficiency and low resistance multi-scale nanofiber mask cartridge, and modified its antibacterial functionalization to give the fiber membrane efficient antibacterial performance. Rahimi A R suggested that chemical recycling is aimed at converting waste plastic polymers into virgin monomers or other valuable low molecular weight chemical products. These products can be used as solid and gaseous fuels or as feed-stock for reproduction in various downstream industries. LEE investigated the recycling of masks by chemical recycling methods. They produce value-added chemicals such as aromatic compounds and carbon monoxide by catalytic pyrolysis of disposable masks at 400-600°C using Ni/SiO₂ and zeolite catalysts. Pyrolysis is an important means of chemical recycling of waste plastics, which has the advantages of environmental

friendliness, low pollution, high utilization rate, high product value, etc. However, it also has the disadvantages of high energy consumption, poor economic efficiency, and the pyrolysis products are not easy to separate. Sun Xuli took the discarded disposable medical masks produced in the new crown pneumonia epidemic as the research object, and used a two-stage temperature-controlled vertical fixed-bed reactor to investigate the effects of the thermal cracking temperature and time of the masks, the volatile reaction temperature and the catalytic cracking catalyst on the product yield and the composition of the gas-liquid products. Briassoulis D et al. concluded that waste plastics can be further recycled after washing and mechanical crushing. For most thermoplastic waste plastics, reuse can be achieved by mechanical crushing and hot extrusion of mixed binders. For PE, PVC and other waste polymer films, they can be directly converted into other molded plastic products by simple mechanical shredding, washing, drying and then hot extrusion. Similarly, for disposable masks can be directly recycled as additional material after mechanical shredding. Shannon et al. and Saberian et al. The use of disposable mask fragments filled with concrete as an alternative to pavement base/sub-grade not only reduces the waste generated by the outbreak and the need for raw materials, but also significantly reduces the construction cost.

In summary, previous literature has rarely dealt with how communities can regulate the disposal of discarded masks, this paper will investigate and analyze the disposal of discarded masks in the community, and put forward countermeasures on how communities can regulate the disposal of discarded masks to eliminate the pollution and hazards caused by discarded masks.

3 Research methodology

Due to the epidemic, this paper collects questionnaires through online network questionnaire, and conducts a full investigation and analysis of different residents' knowledge of mask pollution and disposal of discarded masks, and collects a total of 315 valid questionnaires. The questionnaires included gender, age, occupation, ways of disposing of discarded masks, basic knowledge of the disposal of discarded masks, the use of special garbage cans for recycling discarded masks, and satisfaction with the current situation of the disposal of used masks. In order to ensure the smooth process and the validity of the questionnaire, we made a detailed description of each part of the questionnaire, and required that the questionnaire respondents have a smartphone, are literate, and are willing and able to fill out the questionnaire independently, and complete it successfully with the help of the gridgers.

4 Questionnaire results and model analysis

4.1 Results of the questionnaire survey

(1)Waste Mask Disposal Methods

No treatment was done and thrown into ordinary garbage cans for 256 people, accounting for 81.27%; 21 people, accounting for 6.67%, were put into sealed bags and then disinfected and put into special masks to dispose of the garbage garbage cans; 15 people, accounting for 4.76%, were thrown away randomly; and 23 people, accounting for 7.30%, were other people.

(2)Basic knowledge of community residents on disposal of discarded masks

150 (47.62%) knew and could do it; 130 (41.27%) knew but could not put it into practice; 25 (7.94%) did not know and 10 (3.17%) others.

(3)Use of special garbage cans for recycling of discarded masks by community residents

30 or 9.52% were always placed; 95 or 30.16% were often placed; 176 or 55.87% were occasionally placed; and 14 or 4.44% were never placed.

(4)Community attitudes towards the current situation of disposal of discarded masks

16 people, or 5.08%, were very satisfied; 132 people, or 41.90%, were more satisfied; 155 people, or 49.21%, were dissatisfied; and 12 people, or 3.81%, were unaware of the current situation.

4.2 Model analysis

In this paper, we selected three variables, represented by X, Y, and Z respectively, as whether community residents think waste mask disposal is reasonable or not, whether the community has set up special garbage cans for waste masks, and whether there is publicity for waste mask disposal in the community. We performed correlation analysis on the relevant variables [6]. The formula for the correlation coefficient:

$$\rho_{X,Y} = \frac{\text{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

The matrix of correlation coefficients for the three variables was obtained through statistical software as follows:

$$\begin{bmatrix} 1 & 0.57 & 0.49 \\ 0.57 & 1 & 0.93 \\ 0.49 & 0.93 & 1 \end{bmatrix}$$

We can see that the correlation coefficient between whether community residents believe that the disposal of discarded masks is reasonable and whether the community

has set up special garbage cans for discarded masks is 0.57, the correlation coefficient between whether community residents believe that the disposal of discarded masks is reasonable and whether there is publicity for the disposal of discarded masks in the community is 0.49, and the correlation coefficient between whether the community has set up special garbage cans for discarded masks and whether there is publicity for the disposal of discarded masks in the community is 0.93. All three variables are positively correlated with each other, and the positive correlation between whether or not the community sets up special garbage cans for discarded masks and whether or not the community has publicity for discarded mask disposal is large and close to 1.

5 Conclusion

The "new pollution" of discarded masks is both a traditional pollution phenomenon and an emerging environmental pollution problem, and this phenomenon will become the norm in the future. To effectively solve this "new type of pollution" problem, strengthen the awareness of all people, change the behavior of all people is a prerequisite for legislation to regulate the behavior of all people is a means of research and development, application of biodegradable materials is fundamental. Only by adhering to the comprehensive management, can be effective for a long time.

5.1 Strengthening community awareness-raising and guidance on the hazards of discarded masks

Strengthening publicity and guidance on the hazards of discarded masks plays an important role in the smooth implementation of the disposal of discarded masks. Community administrators should choose the most effective publicity methods for people of different age groups and adopt diversified publicity to truly achieve broad coverage, not only to prevent secondary pollution caused by discarded masks, but also to facilitate the proper disposal of discarded masks by community residents. According to the characteristics of the times, the community should pay attention to the publicity and education on the network and social platforms, with the help of online Internet channels, such as in the community property group, grid group of discarded masks norms and special garbage cans to set up a detailed explanation of the drop point of the discarded masks, calling on residents to accurately dispose of the discarded masks, will be used masks placed in the discarded masks of the special garbage cans, but also through the public welfare text messages, the community public number to push, It can also emphasize the hazards of discarded masks through public service SMS, community public number push, popular APPs, etc., increase the publicity of correctly disposing of masks, and guide the public to put discarded masks in accordance with the requirements. In addition, you can also organize volunteers or related personnel to teach how to deal with discarded masks offline, such as making understandable paper, brochures and other forms of bulletin boards or building posting, the use of commuting time to use the loudspeaker broadcasting cycle, door-to-door distribution of publicity newspaper, multi-channel and multi-faceted to

do a good job in the promotion of discarded masks and the correct way of putting the points, to ensure that to enhance the rate of knowledge of the community and the accurate rate of residents, to achieve the participation of everyone, everyone's action, everyone's actions. Everyone participates, everyone takes action, everyone promotes, supervises and reminds each other, and develops good habits of household waste disposal.

5.2 Strengthening the placement and regulation of special garbage cans for discarded masks in the community

Through the field research, according to the degree of community population mobility to divide the community into a number of areas, such as community entrances and exits, building exits, watering places and other locations, put eye-catching discarded masks put garbage cans, garbage cans with sensors, in order to facilitate the automatic opening and closing of the garbage cans and can show whether it is full or not, to avoid direct contact between people and the barrels, and to facilitate the community residents to put the discarded masks. At the same time, the community grid clerk can increase the frequency of patrol visits, strengthen the care of special trash cans, statistics on the use of trash cans, and timely adjustment of the best place to put the trash cans to strengthen the supervision [7]. In addition, the waste masks put into the garbage cans should be collected by the property cleaning personnel at regular intervals every day, transported by special trucks, compressed in advance and then transferred to the designated location for immediate incineration, to ensure that the closed-loop operation mode of "unified collection, unified hauling and unified treatment", to avoid the risk of infection from the source.

5.3 Multi-measures and innovations to motivate community residents to take the initiative to recycle discarded masks

The community should think of innovative ways to fully mobilize community residents to take the initiative to recycle discarded masks with the help of material incentives, and guide residents to correctly dispose of discarded masks to reduce the spread of germs and avoid causing secondary pollution. Communities can organize "discarded masks for new" activities, set up to the family as a unit will be discarded masks cut up into self-sealing bags and thrown into the discarded masks special trash cans, with the recorded video can contact the community door to get a new masks of the rules of the activities; held discarded masks special trash cans "national Punch Card" activity, requiring residents to put discarded masks into self-sealing bags and throw them into the garbage can for discarded masks, then they can scan the "punch card code" on the top of the garbage can and collect all the codes to participate in the lucky draw, and the winners can get new masks free of charge; organization of the "Collect Likes to Win Gifts" activity, uploading correctly disposed of masks into the garbage can, and then contacting the community to collect new masks with the recorded video. The "Collect Likes to Win Gifts" campaign is organized, in which you can upload videos or photos of correctly disposing of discarded masks, and

receive gifts based on the number of likes collected in your circle of friends, and so on. These promotional activities not only recycle discarded masks and prevent the secondary pollution of discarded masks, but also carry out human propaganda and help the community gradually form good habits.

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