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ENVIRONMENTAL IMPACT OF DISPOSABLE MASKS AND SOLUTIONS TO THE ISSUE

With the onset of the Coronavirus pandemic, humanity faces an increase in the volume of such waste as medical masks. Despite the fact that many people use reusable rag masks, experts estimate that 6.8 billion disposable face masks are utilized every day in the world. This puts us in front of the problem of accumulation and recycling this type of waste.

According to University College London's Plastics Innovation Hub, if just half of the UK's population used one disposable mask per day for a year, that adds up to around 12 billion masks a year, creating more than 30,000 tons of contaminated plastic waste [3]. In the coastal waters of Hong Kong, where millions of people use disposable medical masks every day, a huge number of used masks are found. Masks end up in the ocean along with the rest of the debris and litter the water and beaches. According to ecologist Gary Stokes, this harms not only the people of Hong Kong, but the entire ecosystem [1].

A modern mask usually consists of a filter layer, located between the two outer layers (three-layer masks), as well as a flexible aluminum insert that ensures the mask fitting to the shape of the nose. The mask is fixed on the face by means of elastic ear loops or ties. The main material for the filter layer of the masks is non-woven polypropylene [4].

The advantages of polypropylene make it possible to use in many industrial areas:

1. High strength, resistance to abrasion and bending;
2. Does not change structure at high temperatures;
3. Chemicals of low concentration do not affect the structure of the material;
4. High adsorption capacity;
5. Tactile feeling is similar to cotton materials;
6. Hypoallergenic.

However, according to Mask Bros, "Regular masks have many different types of plastic for each layer, as well as metal nose clips and elastic ear loops, which means they cannot be recycled [6].

The EcoBreath mask is "the world's first recyclable face mask as it is 100% polypropylene." Like conventional surgical masks, they are made from high density non-woven polypropylene and don't have those non-recyclable features.

The company says it is negotiating with local authorities to dispose of masks along with plastic wrap as part of its recycling programs as a grade 5 wastes[3].

The company has spoken in detail with various recycling organizations as well as with WRAP (Waste and Resource Action Program) to confirm that the information it provides to customers is accurate and will not cause problems for local recycling companies. WRAP says there is no way to recycle masks, not even into the materials from which they are made. At present, there is no technology for fast separate collection of recyclable face masks from non-recyclable ones at a recycling factory. In addition, there is a demand for systems to protect workers from contamination [7].

Dr. Mohammad Saberian was the first to state that interdisciplinary and collaborative approaches are now needed to address the environmental impact of COVID-19, especially the risks associated with disposing of used PPE. "This initial study looked at the feasibility of recycling single-use face masks into roads and we were thrilled to find it not only works, but also delivers real engineering benefits," Saberian said [2]. "We hope this opens the door for further research, to work through ways of managing health and safety risks at scale and investigate whether other types of PPE would also be suitable for recycling."

The Brazilian Association of Environmental Sanitation Engineers (ABES) has issued guidelines for the proper disposal of used masks and gloves. Materials should be placed in two large plastic bags, one inside the other. The bags should be tied tightly and disposed of with household waste. If the materials come into contact with an infected person, it is necessary to write "RISK OF INFECTION" on the bag.

At present, the possibility of building automobile roads from the used face masks is being considered [2]. Roads are made of four layers: subgrade, base, sub-base and asphalt on top. All the layers must be both strong and flexible to withstand the pressures of heavy vehicles and prevent cracking. Processed building rubble - known as recycled concrete aggregate (RCA) - can potentially be used on its own for the three base layers. But the researchers found that adding shredded face masks to RCA enhances the material, while simultaneously addressing environmental challenges on two fronts: PPE disposal and construction waste. Construction, renovation and demolition account for about half the waste produced annually worldwide. In Australia, about 3.15 million tons of RCA are added to stockpiles each year rather than being reused.

The study identified an optimal mixture - 1% of shredded face masks to 99% RCA strengthens it, while maintaining good adhesion between the two materials. The mixture performs well when tested for stress, acid and water resistance, as well as strength, deformation and dynamic properties, meeting all the relevant civil engineering specifications [2]. While the experimental study was conducted with a small amount of unused surgical face masks, other research has investigated effective methods for disinfecting and sterilising the used masks

A comprehensive review of disinfection technologies found that 99.9% of viruses could be killed with the simple "microwave method", where masks are sprayed with an antiseptic solution, then microwaved for one minute. In the related work, the RMIT researchers have also investigated the use of shredded disposable face masks as an aggregate material for making concrete, with promising preliminary findings. Professor Jie Li leads the RMIT School of Engineering research team, which

focuses on recycling and reusing waste materials for civil construction. Plaxtil was launched in November 2019. It specialises in recycling clothes by turning them into a plastic-like material – also called Plaxtil. When the Covid-19 pandemic hit, it switched to recycling masks, instead. First, the masks are collected and placed in “quarantine” for four days. They are then ground down into small pieces and subjected to ultraviolet light to ensure they are completely decontaminated before the recycling process begins [5].

According to the research, we need 3 million masks to create one kilometer of a two-lane road, which could become 93 tons of waste in a landfill. Developed by the researchers at RMIT University in Melbourne, the new road material is a blend of crushed disposable face masks and treated construction rubble designed to meet civil engineering safety standards.

Studying the above researches, we can conclude that we have the opportunity, using foreign technologies, to introduce a large-scale processing of masks in Ukraine. This would allow us to use resources more rationally, protecting the environment from anthropogenic sources of pollution. Large companies can take responsibility for the processing of masks, thereby fulfilling their own industrial and economic needs and helping the state to address an urgent problem. The government can financially support these companies, subsidize or temporarily remove them from compulsory taxes.

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