

## COVID-19: Challenges and Perspectives for the Pulp and Paper Industry Worldwide

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The outbreak of coronavirus disease 2019 (COVID-19) has made a huge impact on the global industrial supply chains. Undoubtedly, COVID-19 is posing severe challenges to the pulp and paper industry worldwide. On the other hand, this pandemic may provide unprecedented possibilities for the pulp and paper manufacturers in areas such as the increasing demand for personal hygiene paper products, food packaging products, corrugated packaging materials, medical specialty papers, etc.

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### The Background of COVID-19

Coronaviruses (CoVs) are enveloped, single-stranded RNA viruses that are widely found in mammals, including humans (Kandel *et al.* 2020). Although most human CoVs cause only mild diseases, severe human infectious diseases caused by some specific CoVs such as SARS-CoV and MERS-CoV have appeared in recent years. The mortality rates of SARS-CoV and MERS-CoV have been reported to be 10% and 37%, respectively (Memish *et al.* 2020).

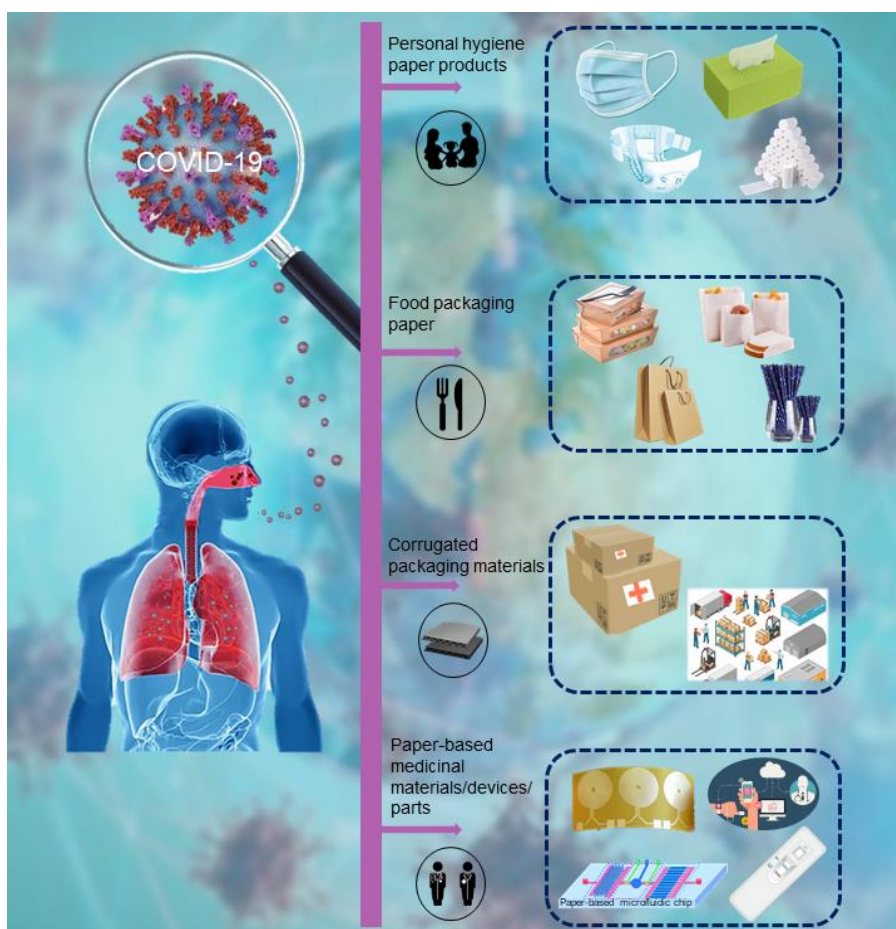
In December 2019, a cluster of unexplained pneumonia symptoms were observed. Within a short period of time, scientists confirmed this pneumonia to be a disease caused by a novel CoV (ASRS-CoV-2), and the entire genome sequence of this virus was subsequently reported (Li *et al.* 2020). Later on, the disease was named “coronavirus disease 2019” (abbreviated as COVID-19) by the World Health Organization (WHO). Compared to the seasonal flu, COVID-19 appears to be more contagious and fatal so far. Since the outbreak, the number of newly diagnosed cases of COVID-19 has increased dramatically. At the time of writing, there are nearly 1.4 million confirmed cases of COVID-19 worldwide with more than 70,000 deaths, according to Worldometers real-time statistics ([www.worldometers.info/coronavirus/](http://www.worldometers.info/coronavirus/)).

In the context of the deep integration and globalization of the world economy, COVID-19 has brought severe challenges to global industrial supply chains. In view of these circumstances, the question to be addressed in this editorial is, what will COVID-19 bring to the pulp and paper industry?

### The Impact of COVID-19 on the Pulp and Paper Industry

The pulp and paper industry comprises companies that use basic raw materials (*e.g.* wood) to produce pulp, paper, paperboard, and various cellulose-based products.

Such activities are closely related to the development of the global economy and the construction of social civilization (NPCS Board of Consultants & Engineers 2017). According to the official data, annual global paper and board production and consumption capacities have reached 419.7 million metric tons and 423.3 million metric tons, respectively (Statistics 2019). The pulp and paper industry involves many fields such as forestry, agriculture, chemicals, biology, distribution, and transportation, thus occupying an important position in the global economy (Huang *et al.* 2019a). The COVID-19 pandemic has severely affected people's lives, industrial production, and the global economy, which inevitably induced a major impact on the pulp and paper industry. For example, copier paper and printing paper have seen a notable decrease in demand recently due to the shutdown of colleges and universities. On the other hand, as illustrated in Fig. 1, increasing demand for some paper products have also come from this pandemic, mainly reflected in the following aspects:



**Fig. 1.** The potential increasing demand for paper products amid the COVID-19 pandemic

- Personal hygiene paper products. The demand for hygiene paper products is closely related to people's growing awareness of safety and hygiene. Under the pandemic situation of COVID-19, the demand for disposable paper towels, disinfectant wipes, face masks, disposal paper underwear, and other related hygiene products is rising rapidly.
- Food packaging products. Affected by the COVID-19 pandemic, the social distancing has led to an independent and convenient food and beverage mode

for many people. Paper boxes, straws, paper bags, food packaging papers may become new growth points for the pulp and paper industry.

- Corrugated packaging materials. During the COVID-19 outbreak, corrugated packaging materials are essential for the transport of food, medicines, and medical equipment. In addition, the self-quarantine may accelerate the growth of online shopping in this emergency period. Thus, the demand for corrugated packaging materials may grow rapidly in a short period of time.
- Paper-based medicinal materials/devices/parts (medical specialty papers). As a special type of carrier, paper can be endowed with many functions such as filtration, adsorption, antibacterial and detection by chemical/physical/biological design. Some specialty paper can be used for the production of various medical products (*e.g.* paper electrodes, paper-based microfluidic chips, paper-based biosensors and biological test paper) (Desmet *et al.* 2016). Thus, the pandemic may provide an opportunity for the companies that produce medical specialty papers.

In addition to the potential applications mentioned above, there has been a growing interest in biorefinery processes of lignocellulosic biomass recently, in light of the advantages in efficient fractionation of biomass into cellulose, hemicelluloses, and lignin, which could be converted to fuels, power, heat, functional materials, and value-added chemicals (Lin *et al.* 2019; Huang *et al.* 2019b). Several nanomaterials such as nanocellulose and lignin nanoparticles have been prepared as intermediate products during the biorefinery process, and these have shown great potential for applications in the biomedical and pharmaceutical fields (Figueiredo *et al.* 2018; Dong *et al.* 2020). Taking nanocellulose as an example, it is reported that nanocellulose with excellent mechanical stability, low toxicity, biocompatibility, and biodegradability have been widely demonstrated for use in a broad range of biomedical applications such as drug delivery, tissue engineering, wound dressing, cancer treatment, biosensors, to name just a few (Du *et al.* 2019). The research in this field is expected to provide a possibility for the prevention and treatment of infectious diseases in the near future.

### **Possibilities**

The COVID-19 pandemic is posing serious challenges to the pulp and paper industry due to its disruption to global industrial supply chains. However, it has potential to create positive demand for a variety of paper products such as personal hygiene paper products, food packaging products, corrugated packaging materials, and medical specialty papers. Thus, traditional pulp and paper manufacturing operations are expected to be transformed, upgraded, and integrated to reduce the risks associated with this pandemic. In addition, the biorefinery process may open an opportunity for the traditional pulp and paper industry.

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