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1 **Short Communication - The COVID-19 pandemic and single-use plastic waste in**
2 **households: a preliminary study**

3

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7

8 **Highlights**

- 9 - The results of a worldwide survey with 202 respondents from 41 countries are
10 presented
- 11 - The COVID-19 pandemic led increased consumption of single-use plastics
- 12 - The main reasons seem to be associated with food packaging and of single-
13 use plastic bags
- 14 - The results indicate promising opportunities for the packaging industry

15

16 **Abstract**

17 The Coronavirus pandemic promoted an unprecedented change in consumption
18 habits, especially as lockdowns contributed to the increase in online shopping and in
19 delivery services. One of the consequences is the substantial amounts of plastic waste
20 produced, which can undermine the efforts to reduce plastic pollution. In this context,
21 this commentary explores, as a preliminary study, the impacts of the Coronavirus
22 pandemic in relation to single-use plastic waste in households by means of an
23 international survey with 202 participants distributed over 41 countries worldwide.

24 **Keywords:** COVID-19; Waste generation; Waste management; Household waste,
25 Plastic pollution

26

27 **Introduction: Plastic waste and its growth in the time of COVID-19**

28 For many years, plastic waste has become a matter of great international concern, especially
29 plastic debris in oceans (Leal Filho et al. 2019). This concern has been intensified during the
30 COVID-19 pandemic, in the context of which the amount of plastic waste has increased
31 substantially. This increase is associated with significant pressures and dangers to
32 ecosystems and to the natural environment (Silva et al., 2021).

33 The levels of both macro (e.g. large particles) and micro plastic (e.g. plastic fragments less
34 than 5 mm in length) have increased significantly in connection with the consumption of plastic
35 based materials associated with the treatment of patients and general health care associated
36 with COVID-19. This was mainly attributed to the discarding of single use personal protective
37 equipment (PPE) which are most made of plastic. This includes disposable gloves and masks.
38 It was found that the global plastic consumption of medical gloves and face masks worldwide
39 in 2020 was approximately 69 billion units per month (Kalina & Tilley, 2020). The increase in
40 plastic production has added a considerable pressure to the developing countries that already
41 struggled with the handling of plastic waste prior to the pandemic (Parashar & Hait, 2020). This
42 was further increased by the amount of plastic used for packing in e-commerce and food
43 takeaways (Parashar & Hait, 2020), a phenomena partly related to the limited availability of
44 bio-based plastics, whose use is not as detrimental to the environment (Silva et al., 2021).

45 Another example of increased plastic usage can be provided from China, where plastic waste
46 increased from 40 tonnes per day before the pandemic, to around 240 tonnes per day during
47 the pandemic. Furthermore, the amount of medical waste generation containing significant
48 percentages of plastics showed a rise of 370% during the pandemic (Klemeš et al., 2020;
49 Parashar & Hait, 2020).

50 These examples, and other documented in the literature (e.g. ESDO 2020) illustrate how the
51 substantial amounts of plastic waste produced during the time of the pandemic have been
52 undermining the global efforts to curb plastic waste pollution. The lockdowns, the increase in

53 online shopping and in delivery services have also contributed to change in consumption of
54 plastic products in households. In this context, this commentary focused on exploring the
55 impacts of pandemic in relation to single-use plastic waste in households.

56

57 **Exploratory Study**

58 In order to understand the impacts of the crisis caused by COVID-19 in relation to single-use
59 plastic waste in households, a quantitative approach is used. The data collection for the self-
60 report study followed a structured questionnaire survey (see Appendix A), made available
61 through the online platform Google Forms between February and April 2021. The survey
62 consisted of a total of twelve closed-ended questions on demographic details and aspects of
63 consumption of single-use plastic waste in households. The survey instrument was then
64 shared with a global audience via various scientific mailing lists, the networks of the European
65 School of Sustainability Science and Research (ESSSR), and the Inter-University Sustainable
66 Development Research Programme (IUSDRP).

67 The sample was composed of 202 respondents from 41 countries (Australia, Austria,
68 Bangladesh, Belarus, Brazil, Cameroon, Canada, Chile, Côte d'Ivoire, Cyprus, Denmark,
69 Egypt, Finland, Germany, Ghana, Guatemala, India, Iran, Ireland, Italy, Japan, Lithuania,
70 Malaysia, Malta, Mexico, Nigeria, Peru, Philippines, Portugal, Romania, Serbia, Singapore,
71 Slovenia, Spain, Sri Lanka, Sweden, Switzerland, Uganda, UK, USA, Vietnam). Around two
72 third of the sample is composed of women (67% female, 32% male, 1% other) and over 75%
73 of the respondents are postgraduates (high school 2%, graduate 21%, postgraduate 77%).
74 Regarding age group, more than half of the sample is divided into the groups of 30-39 years
75 and 40-49 years (27% and 30%, respectively), followed by 22% with 50-59 years, 13% with
76 18-29 years and 8% with 60+ years.

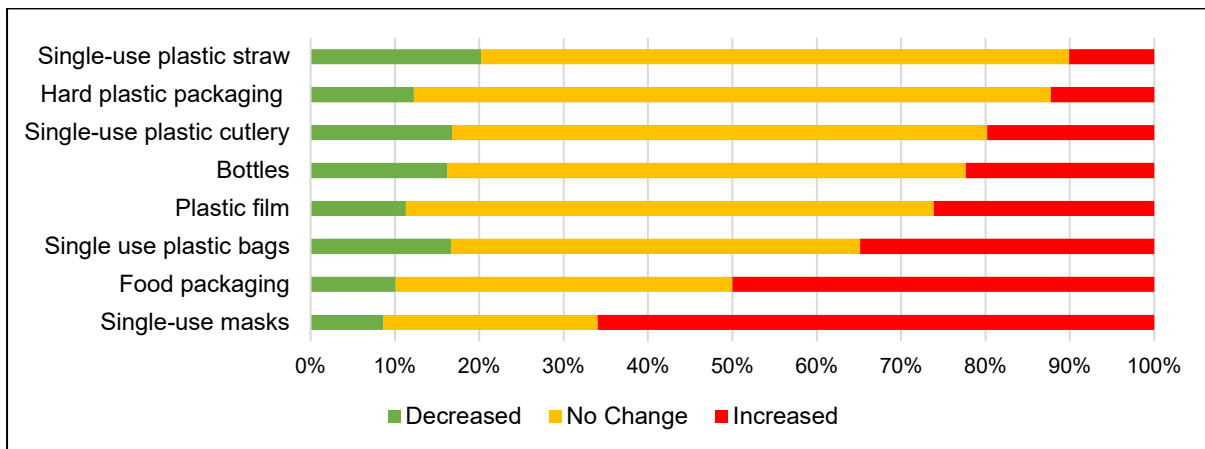
77 When asked about a possible change in the consumption of single-use plastics during the
78 lockdowns, 58% of the respondents indicated that the consumption increased. In general, the
79 increase in the use of single-use plastic was not so expressive though, with more than 1/3 of
80 respondents indicating an increase of 20% or less while only 10% of respondents reported an

81 increase over 30%. Other responses split up between no change in use (27%) and decreased
82 consumption (15%).

83 As can be observed in Figure 1, when asked to specify the changes in the consumption of
84 different materials, it can be noted that for most materials a substantial change in consumption
85 was not observed. The most remarkable results refer to the increase of food packaging in 50%
86 of the households and of single-use plastic bags in 35% of the households. As expected, the
87 majority (66%) increased the consumption of single-use masks, given the mandatory use for
88 health protection. The respondents that indicated decreased or no change in use of these
89 products are probably supporting the use of other alternatives for health protection (reusable
90 cloth masks or reusable face shields).

91

92 Figure 1. Change in consumption of plastic materials during the lockdown (in percentage of
93 respondents per category)



94

95

96 Probably because the general increase rate was not so expressive, the level of worry about
97 the amount of plastic produced in the household during the lockdown was not so high as one
98 could expect, as results from this survey indicate. Only 21% of the sample indicated to be
99 extremely worried, followed by 27% of respondents moderately worried. 15% of the sample
100 indicating not being worried at all. On the other hand, over 90% of the sample expressed

101 concern in terms of impact of plastic waste in the environment (69% extremely concerned and
102 22% quite concerned).

103 The survey also investigated different efforts to separate plastic waste and to reduce the
104 consumption of single-use plastics. Both indicated positive results: almost 85% of the
105 respondents said they already used to separate plastic waste and continued doing so during
106 the lockdown and 90% indicated they intend to reduce the use of single-use plastic in their
107 day-to-day life after the pandemic. Regarding ways of reducing this consumption, the most
108 voted initiative was buying fewer packed food (selected by 65% of the respondents), which
109 indicates an interesting potential for the industry of alternative packaging products and for
110 brands to re-think their products' design. Around 59% of the respondents indicated both re-
111 using plastic bags and using cloth/fabric bag for shopping, followed by 52% of responses
112 stating intention to avoid the use of plastic straws. Other responses included using stainless
113 steel cutlery (39%), buying drinks in glass bottles instead of plastic bottles (33%) and using
114 glass or steel containers for shopping (33%).

115

116 **Conclusion**

117 The results of this preliminary and self-report study show that, as expected, the COVID-19
118 pandemic and its consequents lockdowns brought changes in consumers' behaviour, not only
119 regarding their buying patterns but also in the amount of waste produced. Here we intended
120 to analyse the production of household plastic waste, as well as single use products as the
121 disposable gloves and masks. In fact, more than half of the consumers inquired assumed that
122 its consumption augmented, emphasising the increase of food packaging and of single-use
123 plastic bags. Even so, a considerable number of individuals are making efforts to separate
124 plastic waste and to reduce the consumption of single-use plastics.

125 When thinking about ways of reducing this plastic consumption, one of the solutions proposed
126 was buying fewer packed food. Thus, the food industry and the retailers could take advantage
127 of this business opportunities by providing alternative packaging (e.g. bioplastics or allowing

128 to purchase in bulk). The reuse is also a strategy that can be implemented by some companies
129 since consumers show some predisposition to enter in the circular economy.

130 Communication professionals, and non-governmental environmental organizations, should
131 make an effort to sell the idea of limiting the use of unnecessary single-use plastic during the
132 pandemic, promoting other ways of consuming certain items (ex. reusable masks). It is
133 necessary not to forget that the impact of the single-use plastic aggravated with this pandemic,
134 will last for many years.

135 In future it would be useful to research more about green consumer buying behaviour in
136 pandemic scenarios, relating it, not only with plastic waste, but also with other waste
137 production in households.

138

139 **References**

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141 ESDO. (2020). ESDO's Online Press Briefing on Covid-19 Pandemic Outbreak 14,500 Tons
142 of Hazardous Plastic Waste in a Month. Retrieved from [https://esdo.org/esdos-online-
143 press-briefing-on-hazardous-plastic-waste-generation-in-a-month-during-covid-19-
144 pandemic](https://esdo.org/esdos-online-press-briefing-on-hazardous-plastic-waste-generation-in-a-month-during-covid-19-pandemic)

145 Kalina, M., & Tilley, E. (2020). "This is our next problem": Cleaning up from the COVID-19
146 response. *Waste Management*, 108, 202-205.
147 doi:<https://doi.org/10.1016/j.wasman.2020.05.006>

148 Klemeš, J. J., Van Fan, Y., Tan, R. R., & Jiang, P. (2020). Minimising the present and future
149 plastic waste, energy and environmental footprints related to COVID-19. *Renewable
150 and Sustainable Energy Reviews*, 127, 109883.
151 doi:<http://doi.org/10.1016/j.rser.2020.109883>

152 Leal Filho, W., Havea, P.H.H., Balogun, A-L., Boenecke, J., Maharaj, A. A., Ha'apio, M.,
153 Hemstock, S. L. (2019) Plastic debris on Pacific Islands: Ecological and health implications,
154 *Science of The Total Environment*, Volume 670, 2019, pp. 181-187,
155 <https://doi.org/10.1016/j.scitotenv.2019.03.181>.

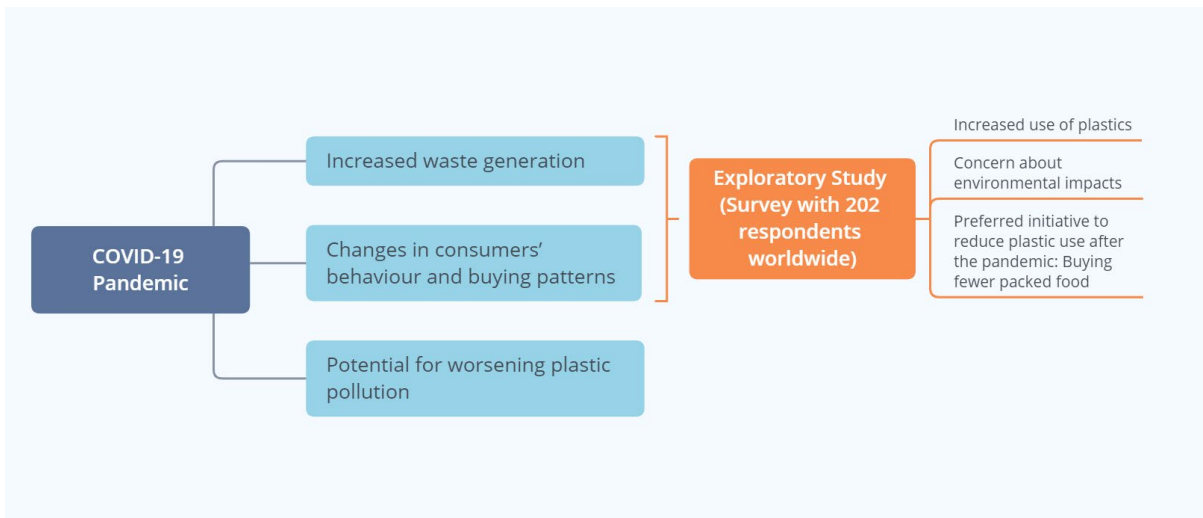
- 234 By buying fewer packed food
- 235 By re-using plastic bags for shopping
- 236 By using cloth/fabric bag for shopping
- 237 By buying drinks in glass bottles instead of plastic bottles
- 238 By using stainless steel cutlery
- 239 By using your own glass or steel containers for shopping
- 240 By avoiding the use of single-use plastic straws (use metal or paper straws or use no straw at all)
- 241
- 242
- 243

- 244
- 245 12. How concerned are you about the impacts of plastic waste to the environment?
- 246 Very concerned indeed
- 247 Quite concerned
- 248 Concerned
- 249 Not so concerned
- 250 I have no concerns at all
- 251

252
253

254 **Graphical abstract**

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256
257