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Evaluation of the disposable masks residues generated during the Covid-19 Pandemic in the district of Barranca

[Evaluación de los residuos de mascarillas desechables generados durante la Pandemia de Covid-19 en el distrito de Barranca]

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Resumen

Esta investigación trata sobre la evaluación de los residuos de mascarillas desechables generados durante la pandemia. El objetivo fue determinar la cantidad de residuos de mascarilla desechables generados en Barranca. Se basa en el método descriptivo para lo cual, se estableció la muestra de 50 casas determinado por el método de Kunitoshi y se aplicó un cuestionario sobre qué actitud toma al momento de reciclar los residuos de mascarilla, también se hicieron la segregación de los residuos para determinar sus características, cuantificación por mes, per cápita y porcentaje de residuos de mascarilla por mes. Se concluyó que, el mayor porcentaje de residuos de mascarilla hubo en setiembre con 1.44 % (1568.95 Kg/ 50 casas/mes) es decir que de 100 Kg de residuos 1.44 kg son de mascarilla; por lo tanto, se debe tener en cuenta el uso adecuado y reciclamiento de este material con la finalidad de reducir la contaminación ambiental.

Palabras clave: Residuos domiciliarios, Mascarilla, Caracterización, Cuantificación, Actitudes.

Abstract

These research deals with the evaluation of disposable mask waste generated during the pandemic. The objective was to determine the amount of disposable mask waste generated in Barranca. It is based on the descriptive method for which, the sample of 50 houses determined by the Kunitoshi method was established and a questionnaire was applied on what attitude it takes when recycling the mask waste, the segregation of the waste was also made to determine its characteristics, quantification per month, per capita and percentage of mask waste per month. It was concluded that the highest percentage of mask residues was in September with 1.44% (1568.95 Kg / 50 houses / month), that is to say that out of 100 Kg of residues, 1.44 kg are of mask; therefore, the proper use and recycling of this material must be taken into account in order to reduce environmental pollution.

Keywords: Household waste, Mask, Characterization, Quantification and Attitudes.

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1. Introduction

From the beginning of the pandemic to the present, the implementation of prevention measures is still mandatory and necessary to reduce the spread of Covid-19, this is because this virus has significantly caused respiratory diseases and in many cases the increase dead. It is also necessary to mention the collapse of health care services and socioeconomic problems in all countries.

Due to this situation, it is important to note that the use of a mask is still necessary to reduce the spread of this virus and even more since the second Wave, it has been forced to use up to two masks in a single use to go to banks, markets and others public places; however, continued use of this material has resulted in skin damage and respiratory distress; for this reason it is necessary to change it continuously to avoid these ailments; according to González et al. (2020), state that thanks to the rapid development of the Covid-19 pandemic, many health professionals have presented skin lesions on their faces, due to the prolonged use of personal protective equipment, to date five forms have been described or clinical presentations of facial injuries.

Therefore, it should be noted that the use of masks has increased significantly in recent months depending on the effectiveness and materials that compose it to protect themselves; However, the waste of this material takes many years to degrade, this is due to its chemical composition. According to San Martín and Camacho (2021) they conclude that surgical masks and high-filtration masks are all made by three layers, although some of them may be double. All these layers are made by TNT, usually of the spunbond or spunlance polypropylene type. The central part that acts as a filter can also be made by electret, which are electrically charged fibers that can trap particles and microorganisms through electrostatic attraction.

It is important to mention that it has been forced to use double masks and even more so with the new variant of Covid 19. This has had an impact on the increase of this material in the percentage of household waste, which is a problem in its final disposal; since its reuse is not favorable either due to its chemical composition. This analysis is supported by Company et al (2020) who conclude that the reuse of masks is not recommended by official bodies or manufacturers, it is only accepted in extraordinary cases, such as pandemics.

For this reason, the investigation was carried out on the evaluation of the waste of disposable masks generated during the Pandemic in the district of Barranca, in order to determine their quantity and how they recycle; which will allow measures to be taken on proper use and recycling in order to reduce environmental pollution.

2. Materials and Methods

Methodology

The research is based on the descriptive methodology; since the questionnaire was used as an instrument to determine the attitude about the recycling of the masks.

Population

The population of the Barranca district is made up of 71,383 inhabitants according to INEI (2016) and its equivalence of 17,129 homes that are located in the urban, peripheral and rural area (INEI, 2017).

Sample

To determine the sample, the number of dwellings was taken into account and with the method of Dr. Kunitoshi Sakurai it was processed with the formula detailed below. This formula has been

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published by the Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS), as shown in the following expression (Cantanhede et. al., 2005).

Equation

$$= \frac{\left(Z^2_{1-\frac{\propto}{2}}\right)(N)(\sigma^2)}{(N-1)E^2 + \left(Z^2_{1-\frac{\propto}{2}}\right)(\sigma^2)}$$

Where:
N = Number of dwellings = 17 129 houses (INEI, 2017)
Z_ (1-∝ / 2)^2 = 1.96. (The 95% confidence coefficient (1-∝ / 2) in waste generation values)
E = 0.056 kg / inhab., Per day; the permissible error is considered 10%. Therefore, the national estimate = 0.56 kg/person, per day.
σ = 0.2, standard deviation, in the variation of household waste generation
n: sample size = 50 houses

Statistical analysis
Obtained the data from the evaluations of characteristics of the household waste and the survey were processed with basic statistics, which were prepared tables and figures that were interpreted and analyzed.

Procedures
The procedures were carried out as follows:

- The sample was determined with the method of Dr. Kunitoshi Sakurai, which obtained 50 houses taking into account the total number of houses in the Barranca district. Likewise, for each house, 4 people were taken into account on average.
- The characteristics of household waste were continuously evaluated, determining the per capita, per month and the percentage of weight of masks in relation to the per capita of the sample. It is worth highlighting the per capita and the percentage of weight of masks in relation to the per capita was obtained from the results of the 1st week of September as a representative evaluation.
- There was also 1 question to a person per household; In other words, 50 people about what attitudes do they take when recycling masks?
- Finally, the data obtained was processed using basic statistics, then interpreted and analyzed.

3. Results

Characterization of residues
According to the evaluation and classification of household waste per month detailed in table 1, it can be seen that in September there was an increase in inorganic waste with 626.6 kg, organic waste with 888.12 Kg and inert waste with 54.23 Kg / month / 50 houses. These amounts are evidenced in the composition of plastic, technopor, packaging, mask and organic waste such as food waste. This is because during the pandemic inorganic wastes increased considerably and even more those that are not usable. Therefore, it is important to consider recycling in homes, workplaces and other places, in order to have a proper final disposal and reduce environmental pollution. The analyzed is supported by Huaman et al. (2021) who conclude that the composition and quantification of solid waste in the community of Vitis, Lima, registered a per capita generation of 0.29 kg / inhabitant/day, density 213.62 kg/m, composition Usable waste (66 %), Unusable Waste (34%), Organic Waste (44%), Inorganic Waste (22%) and plastic (4.5%) of the total

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collected, followed by glass, paper, cardboard, packaging, textiles and metals, with humidity (69.29%).

Table 1: Characterization of household waste Kg / month

Residues Type	Residues	July		August		September	
		Kg	%	Kg	%	Kg	%
	Inert residues	**44.26**	**3.22**	**49.52**	**3.33**	**54.23**	**3.46**
	Soil	44.26	3.22	49.52	3.33	54.23	3.46
	inorganic waste	**555.84**	**40.43**	**610.53**	**41.02**	**626.60**	**39.94**
	Masks	18.86	1.37	19.59	1.32	22.58	1.44
Unusuable waste	Visors	12.6	0.92	13.56	0.91	17.51	1.12
	Syringes	7.5	0.55	9.50	0.64	10.50	0.67
	Pill blisters	12.5	0.91	13.34	0.90	12.58	0.80
	Glass ampoules	14.5	1.05	18.56	1.25	16.39	1.04
	Batteries	47.96	3.49	55.63	3.74	49.85	3.18
	Sanitary waste	58.35	4.24	62.42	4.19	66.23	4.22
Usuable waste	Paper and cardboard	179.1	13.03	204.57	13.74	218.13	13.90
	Plastics	96.39	7.01	104.15	7.00	107.90	6.88
	Metals	31.96	2.32	35.96	2.42	36.85	2.35
	Glasses (bottles)	49.56	3.61	44.40	2.98	43.61	2.78
	Tetra pack containers	26.56	1.93	28.85	1.94	24.47	1.56
	Organic waste	**774.6**	**56.35**	**828.44**	**55.66**	**888.12**	**56.61**
	Kitchen waste	555	40.37	599.63	40.28	638.30	40.68
	Fruit residues	96.6	7.03	88.96	5.98	97.86	6.24
	Garden waste	123	8.95	139.85	9.40	151.96	9.69
	Total	**1374.7**	**100.0**	**1488.49**	**100.0**	**1568.95**	**100.0**

Solid waste per capita

Regarding the per capita evaluation of household waste, which is observed in figure 1, it is indicated that on Friday it stood out with 0.49 kg/person/day of the 1st week of September. This result is interpreted as showing an increase in waste at the end of the week during the pandemic. This is due to the consumption of restaurants, stores and other places of commerce and supply of grocery and basic products at home. Since before the pandemic it was less than this result in the city of Barranca; According to the Provincial Municipality of Barranca (2018), it details that household solid waste presented a total monthly volume of 45.5 m3, equivalent to 540 Tn/Month and with a daily average per capita waste generation equivalent to 0.351 Kg.

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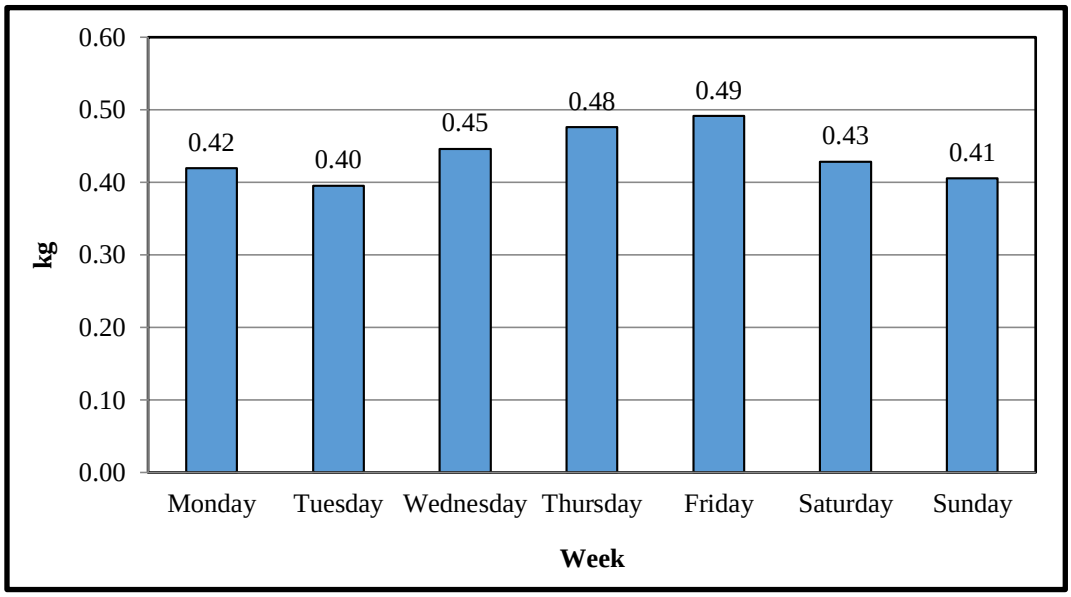

Figure 1: Per capita of household solid waste

Percentage of mask waste per month

Regarding the percentage of mask waste per month that is detailed in table 2, it can be seen that there was an increase in this waste per month, highlighting that in September it was 1.44%; he wants to say it; that out of 100 Kg of household waste, 1.44 Kg are mask waste. Therefore, the increase in this waste should be taken as an indicator, to take attitudes of recycling at home, work centers and other places, for an adequate final disposal; since these masks are manufactured with materials of chemical composition and that take many years to degrade. This analysis is supported by San Martín and Camacho (2021) who conclude that surgical masks and high-filtration masks are all made by three layers, although some of them may be double. All these layers are made by TNT, usually of the spunbond or spunlance polypropylene type. Likewise, Requena et al. (2021) mention that it is important to take this data into account due to the risk of biocontamination presented by waste such as masks and gloves.

Table 2: Percentage of mask waste per month

Amount	Month		
	July	August	September
Weight (kg)	18.86	19.59	22.58
Total weight (kg)	1374.7	1488.49	1568.95
Percentage	1.37	1.32	1.44

Percentage of mask waste based on weight per capita

In relation to the percentage of weight of masks as a function of the per capita weight that is observed in figure 2. It is interpreted that at the end of the 1st week of September, the residuals of the masks increased on Thursday with 2.52% and Friday 2.44%. This percentage is due to the fact that on those days the population travels continuously in public places such as markets, banks, parks and others, which requires a double mask and biosafety standards. Therefore, it is analyzed that this result of this material shows the increase in this return and that proper use and recycling must be taken into account in order to reduce environmental pollution. The analysis is

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based on Caicoya (2020), who states that the disadvantages of the mask are cost, discomfort, improper use, cleaning, recycling and, above all, that not everyone tolerates or is usable in all circumstances.

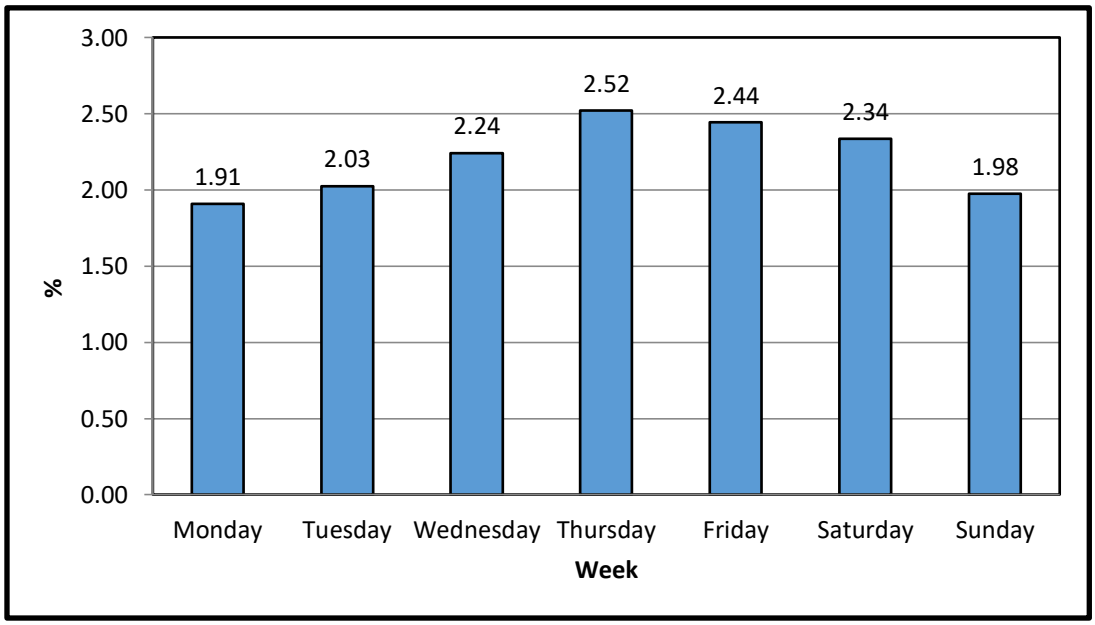

Figure 2: Percentage of mask waste in relation to per capita

Attitude of recycling disused masks

Regarding the attitude of recycling disused masks, the results indicate that 66% do not recycle it; that is, they place it with other waste in a single bag or container, 6% show that a lower percentage of the population places it in inorganic waste bags, 16% throws it away anywhere, be it on the street, public places, etc. and 12% do not think (see table 3). Therefore, a large percentage of the population throws it away with other waste in a single bag to be transported by the collection car and another percentage throws it away in public places. For this reason, it is important to properly recycle and avoid dumping in public places in order to reduce pollution, since these materials, due to their chemical composition, take many years to degrade. This analysis is supported by Flores (2021) who states that the impact of the pandemic has generated an increase in the widespread use of disposable plastic products, such as food containers and medical devices such as masks, gloves, protective suits, among others. both hospital and domestic origin. Likewise, Aguilar et al (2018) conclude that the inappropriate use of solid waste impacts on environmental pollution according to Kendall's Tau-b test is - 0.180, other statistical analyzes and surveys determined that they have a regular level regarding the management of solid waste from their homes, 23.4% presented a good level and 21.9% presented a bad level in solid waste management.

Table 3: Attitude to Recycle disused masks (In %)

	They dump it on the street	They recycle it	They don't recycle it	No opinion
Recycle	16	6	66	12

Note: 50 people 1 per house

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4. Conclusions

- The highest percentage of mask residues was determined in September with 1.44%; which means that out of 100 Kg of household waste, 1.44 Kg are mask waste; Therefore, this result must be taken into account, as an indicator of recycling awareness, so that there is an adequate final disposal of this material.
- The composition and quantification of household waste was also determined, which shows the increase in inorganic waste with 40% on average per month and in per capita with 0.49 kg/inhabitant/day; so it is important that there is adequate recycling in homes, workplaces or other places.
- Regarding the attitude of recycling disused masks, it was determined that the highest percentage does not recycle it; that is, 66% throw it away in a single bag or container and 16% throw it in public places; therefore, it must be taken into account that these materials are manufactured by chemical components and that they must be recycled and not thrown in public places in order for there to be an adequate final disposal.

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