Review

Understanding of Nanofiber Face Mask as Corona Virus Disease Prevention in Human

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ABSTRACT

Background: Corona virus has become a global issue. It makes various countries have taken this outbreak very seriously. One of the necessary precautions is by using a face mask. The nanofiber technology on face masks greatly helps the public and government to increase the prevention of disease spread. The purpose of this study was to conduct a systematic literature review on nanofiber face masks as human corona virus disease prevention. Methods: Stages of systematic literature review of 632 documents was carried out using text mining techniques, while hierarchical cluster analysis were carried out for the extraction of terms in documents. Results: The terms "mask" and "nanofiber" were the most words that appear (more than 40 times) in the WoS and PubMed nanofiber mask document form. On the other hand, the terms "disease" and "respiration" mostly appeared in human corona virus disease prevention. Both of these terms were used to obtain specific articles as a basis for the study of nanofiber mask as human corona disease prevention. Conclusion: This study is very important since prevention measures against corona disease (corvid-19) are a very high concern. The next study is expected to bring this review literature into an experimental study of nanofiber applied to face masks.

Keywords: Nanofiber, Face Mask, Covid-19

1. INTRODUCTION

Diseases originating from viruses and bacteria are health problems that are still difficult to control.[1] Humans live side by side with them and are at risk of being infected for the rest of their lives.[2] But despite all kinds of risks faced, humans are trying to develop various ways to prevent or survive from the Covid19. A report (11th February 2020) in China depicts that a total of 44,672 confirmed cases were reported from 1,386 counties of 31 provinces, autonomous regions, and municipalities.[3]

Today the world is faced with a new disease that comes from the corona virus family.[4] This case is caused by the
Covid-19 which causes respiratory tract and other organ disorders. Most cases of infection and death occur in mainland China and have spread to various countries. WHO has made this case an international emergency on 30 January 2020 in which the vaccine has been tested and will be available for this disease at least at this end of 2020. Although the case fatality rate was lower than SARS and MERS, but Covid-19 has killed more patients. The new virus spreads much more readily than the one that caused severe acute respiratory syndrome, or SARS (also a coronavirus), and has infected more than ten times the number of people who contracted SARS.

Some infected patients have reportedly recovered. Disease countermeasures and prevention have been disseminated and published by WHO and various health service centers around the world related to Covid-19. One of the suggestions from WHO to reduce the spread of this virus is to use medical masks in communities, at home, and in healthcare facilities in areas that have reported outbreaks caused by the 2019 novel corona virus (COVID 19).

The types of masks currently available in the community include ordinary cloth masks, medical masks, and special masks (for example, the N95 respirator type mask). Of the various types of masks, the effectiveness of preventing viral infection from them is still being debated. Cloth masks or medical masks are the easiest to get. This is because besides being available in adequate quantities, the price is also affordable. However, the effectiveness of using any mask is still a big question in dealing with the transmission of the Covid 19 virus or other corona viruses.

Nanofiber technology has been developed to improve mask efficiency. A study states that adding nanofiber to medical masks can increase its utility in dealing with infections of the respiratory tract. This systematic literature study wants to investigate more deeply about nanofiber mask and the prevention of corona virus disease in human. This study is the first step to ascertain whether there is a strong basis for nanofiber applications in medical face masks. The results of this study are very important as a reinforcement of corona virus prevention.

2. METHODS

The data used in this systematic literature review was based on the Web of Science (WoS) and PubMed search engine. First, the search terms were used are “nanofiber face mask” and “human corona virus disease prevention” as the main string to investigate. Second, the finding was only publication between 2010 and 2020, non-English and abstract only will be excluded. We specify with advance search by selecting the topic with “nano-fiber” string as a priority in terms of searching “nanofiber facemask” and “human corona virus” string as a priority in terms of searching “human corona virus disease prevention”. Third, data extraction was performed using text mining by the R program to present the characteristic of publication and statistical methods, such as term quantity, term replication, Hierarchical cluster analysis (HCA) (cluster dendrogram-unsupervised machine learning) and conclusion. Descriptive analysis was used to present the percentage and frequency of data characteristics.

As many as 75 documents were found based on WoS advance search engine and 557 were found based on the PubMed advance search engine. Text mining with R program was performed to investigate the term quantity, replication, and clustering. The results obtained from the analysis were set to find, specify, select, and understand the full-text material of nanofiber facemask as corona virus disease prevention in human.

Text mining started with data preparation that is importing text and string operation. Importing text (txt. File) was carried out from 632 documents abstract. String operation in this case was used to remove boilerplate content, stripping extraneous whitespace, and converting lowercase. A corpus of data and tokenization was built after importing text. The most replied term extracted from the analysis combined into term that will be the focus on for the next investigation. The cluster dendrogram was also applied to see the distance between observations and/or clusters.

3. RESULTS AND DISCUSSION

These results provide an overview of the term frequency and distance of observation. All of these results were obtained and processed through the using of a systematic analysis with the text mining technique.
and the R program. Based on Figure 1, it shows us a description that "mask" has a frequency of 61 times in the text of the document. "Nanofiber" is repeated 48 times. The terms "use" and "electrospun" are repeated 29 times and 30 times. The terms "fiber", "high" and "membrane" are repeated more than 10 times and are less than 20 times.

**Figure 1.** Nanofiber face mask term frequency found in WoS and PubMed 2010-2020

Figure 2 shows that the terms "nanofiber" and "mask" are in the same cluster and have the highest difference compared to other terms (4-6 height). Meanwhile, the other terms that are in different clusters have lower distances (0-3 height). The Figure 3 illustrates that the terms "disease", "respiratory", "infect", "health" and "virus" are the most repeated in text documents about more than 1000 times and are less than 1600 times. The terms "merscov", "china", "coronavirus", "prevent", "control" and "center" are repeated more than 800 and are less than 1000 times. Based on Figures 1 and 3, five new terms are obtained from the string "nano fiber mask", namely "use", "electrospun", "fiber", "high" and "membrane". The new term of the string "human corona virus disease prevention" that is "respiration", "infect", "health", "virus" and "merscov". To simplify the search on search engines, two new terms were most repeated "mask nanofiber disease respiratory". Based on the search results on the two search engines, specific articles were obtained which became the primary reference for the study of nanofiber mask as corona disease prevention in human.

Figure 4 illustrates that the terms "disease" and "detect" have a distance as far as 4 (height) compared to other terms. Other terms that belong to other clusters have a distance in the range 0-2 (height). It should be noted that the dendrogram cluster displayed is part of a very large dendrogram cluster that is not possible to display in full.

4. DISCUSSION

The case of Covid-19 infection has become a worldwide concern. WHO calls it a Public Health Emergency of International Concern. Some countries have raised awareness after many of their citizens have been infected by Covid-19. Caring or curing action for those who have been infected and rehabilitation for
those who have recovered have been carried out to the maximum.\textsuperscript{(21)}

Preventive action is the most important action at this time to reduce outbreaks of covid-19 infection.\textsuperscript{(22)} Several steps that must be done include routinely washing hands and masks to prevent the transmission.\textsuperscript{(23)} The use of masks is now very important since this virus can infect and spread through droplets that appear when a person sneezes.\textsuperscript{(24)} Nowadays masks are becoming high-value medical equipment.\textsuperscript{(25)} The function of medical face masks is to reduce exposure to bacteria and viruses or other hazardous material in the air.\textsuperscript{(26)} Various kinds of medical masks certainly have a variety of different specifications depending on their function and use.

One of the most used masks is medical face masks. This mask is commonly used in various medical services.\textsuperscript{(27)} People can get it at various drug stores or pharmacies. The appearance of this mask consists of two parts, a white part and a blue or green part with hooks used to fasten it to the head or ears. At the top there is a kind of flexible metal whose purpose is to make the mask that attached right to the nose and around the face.\textsuperscript{(28)}

\textbf{Figure 2.} Cluster Dendrogram Nanofiber face mask terms found in WoS and PubMed 2010-2020
Another type of mask is a specific type, N95, which is usually used for individuals who face high exposure to specific hazards (physical, biological or chemical hazards), including bacteria and viruses.\textsuperscript{(29)} This mask provides more protection than previous medical face masks even the effectiveness is still debatable.\textsuperscript{(13)} This is because it has smaller filters for certain types of exposure. Another type of mask is a type of mask with a cartridge that is used by workers exposed to hazardous material.\textsuperscript{(30)}

Based on the results of a systematic literature review, it was obtained that the use of nanofiber for medical face masks is very limited. Improved function of face masks to prevent bacterial transmission has been discussed in a study whose results can improve the function of these masks.\textsuperscript{(15)} Improved function of medical face masks with nanofiber applications provides other options for the community in terms of preventing the transmission of disease.\textsuperscript{(31)} For the government, this can also be an option for maintaining public health.

The problem found is that covid-19 causes respiratory disease and other damage to other organs.\textsuperscript{(32)} Prevention of diseases caused by this virus that can be done is prevention in general, one of which uses medical face masks.\textsuperscript{(33)} Whether medical face masks prevent certain viruses is also still a big question.\textsuperscript{(34)} An effort to reduce this gap is to improve the function of medical face masks with nanofiber applications.

The nanofiber application is expected to provide changes to the structure of the mask filter.\textsuperscript{(35),(36)} If previously the efficiency of facial medical masks had the ability to filter bacteria above 80%, then with the application of this nanofiber, it is expected to reach 95% against particulate aerosols (of 0.3 microns in size) free
of oil as Healthcare or surgical N95 respirator Filtration efficiency. The expected result is that the smaller filter on the mask surface the function will increase. It should be emphasized that the prevention function is inseparable from human actions and behavior. Therefore, the main thing that needs to be improved is human behavior to always live healthily and take action to prevent disease.

5. CONCLUSION

WoS and PubMed document form was used as the document search engine in this literature study. On the other hand, the terms "disease" and "respiration" mostly appeared in human corona virus disease prevention. Both of these terms are used to obtain specific articles as a basis for the study of nanofiber mask as human corona disease prevention. This study is considered to be very important because prevention measures against corona disease (Covid-19) are very high concern. The next study is expected to bring this review literature into an experimental study of nanofiber that is applied to face masks. The hope is to increase the function of face masks that are more effective and specific to the virus.

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Conflict of Interest
The authors declare no conflict of interest.

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