DESIGN OF A PM REMOVING RECIRCULATING HOOD

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Designing a Particulate Matter removing cooker hood that recirculates the extracted air.

BACKGROUND INFORMATION

"Cooking emissions have long been seen as an odour problem. However recent studies showed that Particulate Matter (PM) is the main health risk of indoor air and cooking can be a major source." according to TNO (2016). These health risks can vary from heart diseases, coughing and lung problems (United Stated Environmental Protection Agency, 2016) Therefore, ATAG Nederland B.V. is conducting a research about the possibilities to solve the current problem of a high PM exposure rate in the kitchen. ATAG Nederland is a kitchen appliances company based in the Netherlands and Belgium and has been a leading supplier since 1948. These kitchen appliances are made with the thought 'We love to cook.', because everybody in the company has a passion for cooking. The company is focused on producing better, high-quality, customer-oriented, innovative products for the 'home-chef'. (ATAG, 2017)

PRACTIVAL RELEVANCE

Implementing a PM removal method in a hood can improve the lives of users immensely by filtering the cooking vapours.

MAIN RESEARCH QUESTION

In the design project three different research questions are answered through different analyses. The first being 'What is PM and what is the effect on the health of humans?', the second being 'What is the best method, that will fit in a recirculating hood, to filter PM from the air?' and lastly, 'How will the final design translate into an ATAG worthy product?'. This translates into the design objective of designing an ATAG worthy recirculation hood that removes PM from the air.

APPROACH

To design a PM removing and recirculating hood different concepts were made based on the analyses. These concepts were compared on different levels of a consumer product. The capture efficiency of the concept was checked with airflow simulations, secondly the percentage of fulfilment of different wishes of ATAG were checked and finally the possible integration of a PM removing filter for each concept was graded. These aspects concluded in a well-rounded decision; a downdraft hood solution with not parallel extraction, such as the well-known Bora hood, but angular extraction. The downdraft hood has a good possibility for the integration of the PM filter and matches the current market trends in the kitchen appliance market. To further improve the concept different simulations were made about the distance between the pots, pans and the slot of the hood, the width of the slot, the angle of the extraction and the final extraction speed. This came to a concluding set of measurements that should be the optimal combination. Besides the measurements and capture efficiency, the other requirements from the analyses were met, with a user interface design and a PM removing filter.

RESULTS & LIMITATIONS

As stated before, the result of this thesis is a well-rounded downdraft hood with integrated PM filter. The downdraft hood is placed inside the cooktop and rises with a push-to-open system when in use. The cooking vapours are extracted under an angle to increase the velocity of the air and to make the guidance of the air towards the hood optimal. The necessary grease filters and triangle making the angular extraction possible are hidden under a glass plate and in between two subtle side containers.

Figure 1: The angular extraction hood

Besides a high capture efficiency, the user becomes more aware of the PM in the kitchen when using the hood. This is done via the user interface. The UI is based on the Iris Slide Control, currently used by ATAG in their cooktops. The UI provides information about the necessary level of extraction in order to remove all the odours and PM in the hood. This is a guide for the user to alter its behaviour accordingly. Besides, the user interface shows the filter function, motivating the user to replace the filters in a right time frame, and the automatic function, changing the power level immediately according to the dotted ring.

Figure 2: The Iris Slide Control

Lastly, because the hood recirculates the air the PM must be removed. This is done with a PM removing filter, the smallest, cheapest and easily accessible removing method currently on the market. The filter is placed in the plinth of a kitchen island, behind a ventilation grid. The filter is easily accessible and replaceable by grabbing the container by both sides and guiding it out of the plinth.

Figure 3 The different parts of the PM filter set

CONCLUSIONS AND RECOMMENDATIONS

The stated research questions and design objective are all answered and achieved with this sleek design made for ATAG Nederland B.V. Simulations show the improvement of the angular extraction, the user interface ensures a high level of awareness and the PM filter removes all PM from the air. To further improve the design more knowledge about the PM filters and the automatic function is necessary. Currently the length and height of the PM filter is known, but the width is unknown because test about this filter have not yet been made. The automatic function can be improved with more knowledge about what is in the pan or the exact pan temperature.

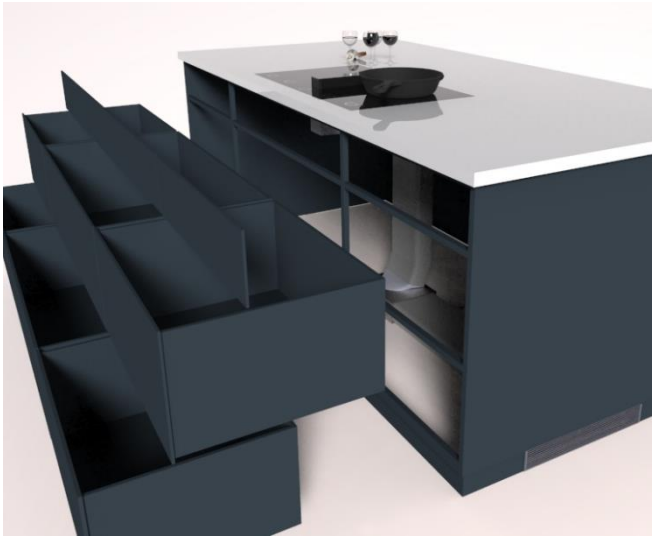

Figure 4: The angular extraction hood on a kitchen island

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