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Air Flow Analysis of Solar Drying Chamber

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Abstract-*This study is based on the drying kinetics of the commodities inside the drying chamber. The air flow inside the chamber determines the drying rate of the commodities placed inside the chamber. To find the maximum area of air circulation inside the chamber to ensure the maximum moisture removal from the commodity and analysed the chamber using SOLIDWORKS FLOEXPRESS ANALYSIS WIZARD and found out the highest possible combination for the inlet and outlet for the chamber which provides maximum area of distribution which results higher drying rates and also determine the shape of the mesh structures*

Keywords-Drying chamber, Flow Express, Flow Analysis

I. INTRODUCTION

In order to solve the problem of growing energy consumption in drying fruits and vegetables and advance the quality of fruits and vegetables processing, a kind of fruits and vegetables dryer was designed based on market demand for the dryer and drying characteristics of fruits and vegetables [1]. In some cases where bioactive compounds extraction cannot be performed on fresh products, drying appears as a necessary step enabling their later use. Drying is a widely used food preservation process in which water removal minimize many of the moisture-driven deterioration reactions impacting the bio-product quality. Dried fruits and vegetables and their application in powder form have gained interest in the food industry [2]. Solar drying of crops,vegetables,fruits has been practiced in the world for many centuries by drying them in the open space. Thus traditional drying suffers from various disadvantages such as uncertainity in the drying time, need of large area, labour force, chances of contamination with foreign bodies. There is also the uncertainity in weather conditions. To overcome these hindrances the introduction of the solar collectors are done and they are developed [3]. The mass flow rate is given as 0.314kg/s

II. ANALYSIS PROCEDURE

The solar drier of dimensions 450mmX600mmX12mm is used for the air flow analysis using the SOLIDWORKS FLOEXPRESS WIZARD. The mesh stand of dimensions 450mmX300mm is used and the size of the mesh is around 3mm. These are the dimensions of the components used in the system. The inlet and exit hole are measured as 50.3mm (2 inches). The probability analysis to find the air flow which covers maximum area of air distribution are changing the position of the inlet and outlet conditions and the alteration in the mesh stand size. By using the SOLIDWORKS FLOEXPRESS ANALYSIS WIZARD under the atmospheric conditions and the mass flow rate at 0.314 kg/s the analysis are undergone the results are discussed as follows

III. ANALYSIS RESULTS

3.1. STRUCTURE OF THE MESH

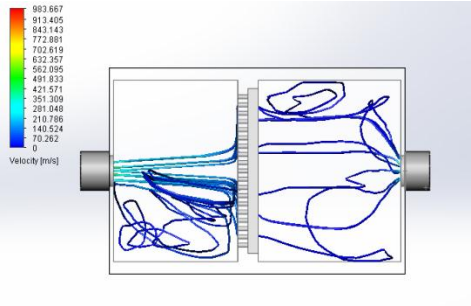

Fig.3.1. Square shaped mesh

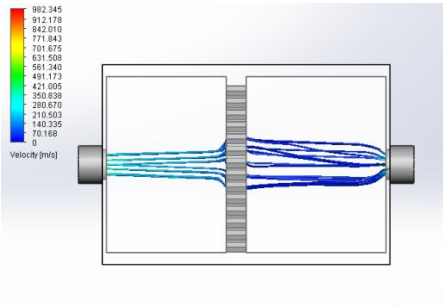

Fig.3.2. Diamond shaped mesh

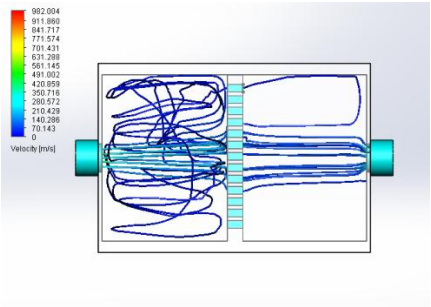

Fig.3.3. Square shaped mesh

3.2.CONSIDERING**A** AS INLET AND **E,F,G,H** AS OUTLETS

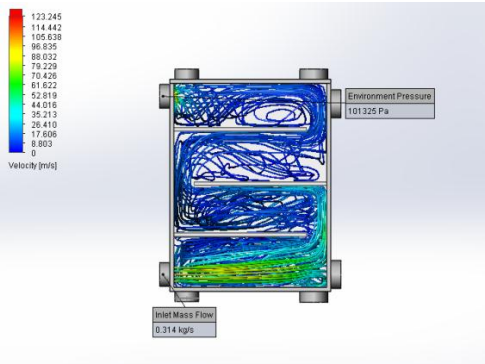

Fig.3.4. A inlet and E outlet

Fig.3.5. A inlet and F outlet

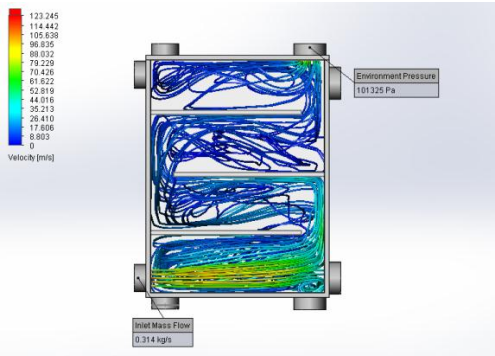

Fig.3.6. A inlet and G outlet

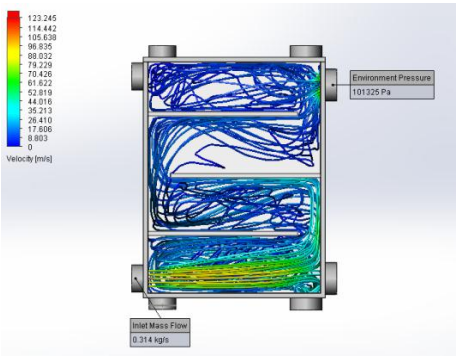

Fig.3.7. A inlet H outlet

3.3.CONSIDERING **B** AS INLET AND **E,F,G,H** AS OUTLETS

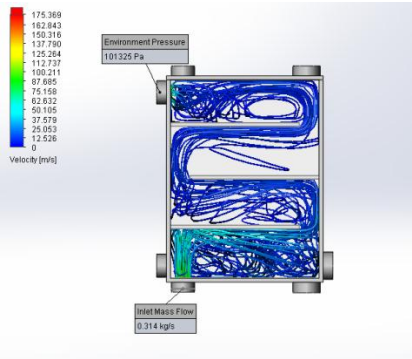

Fig.3.8. B inlet and G outlet

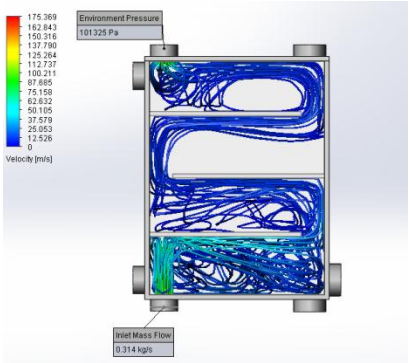

Fig.3.9. B inlet H outlet

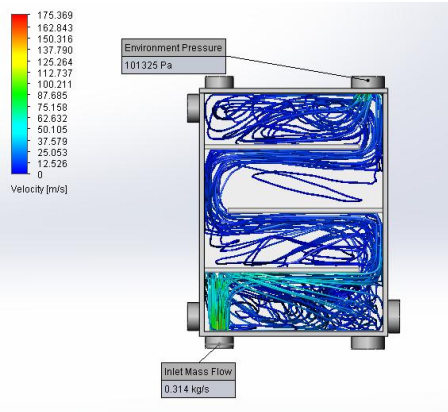

Fig.3.10. B inlet and G outlet

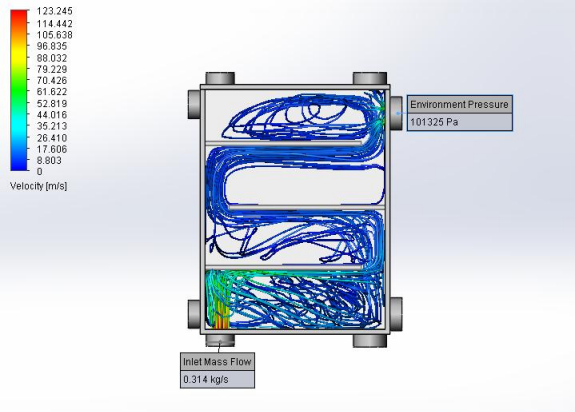

Fig.3.11. B inlet H outlet

3.4. Considering **C** as inlet **E,F,G,H** as outlets

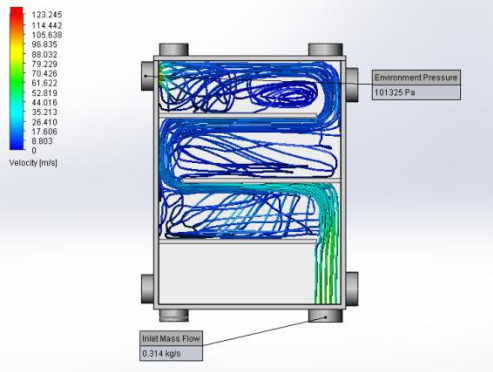

Fig.3.12. C inlet and G outlet

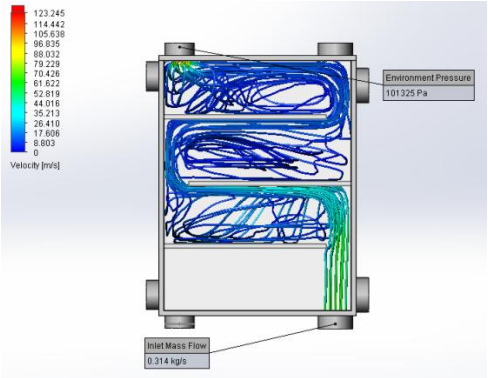

Fig.3.13. C inlet H outlet

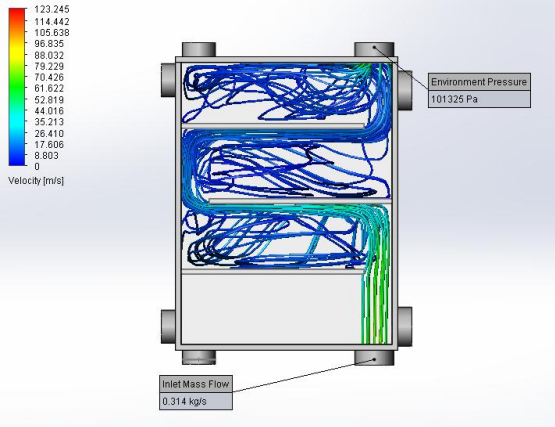

Fig.3.14. C inlet and G outlet

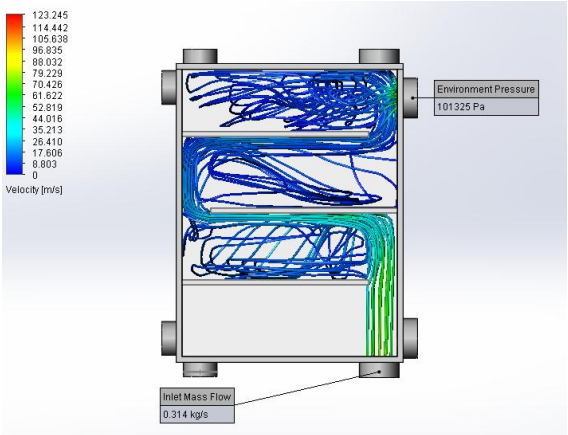

Fig.3.15. C inlet H outlet

3.5. Considering **D** as inlet and **E,F,G,H** as outlets

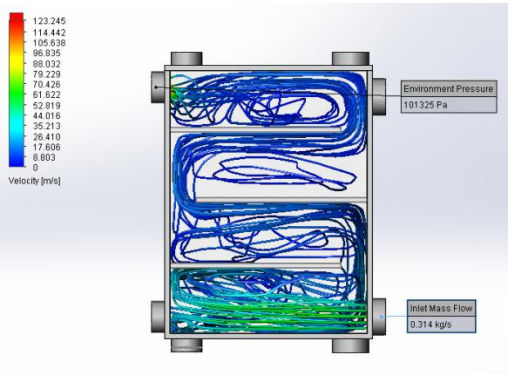

Fig.3.16. D inlet and G outlet

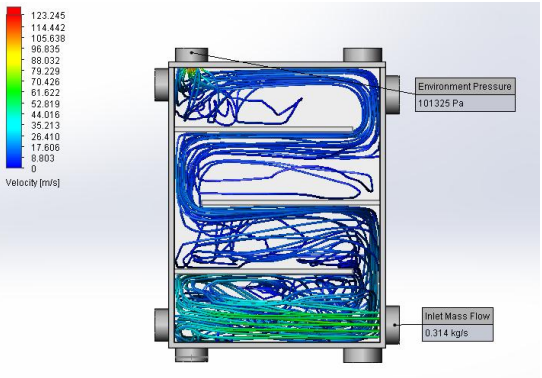

Fig.3.17. D inlet H outlet

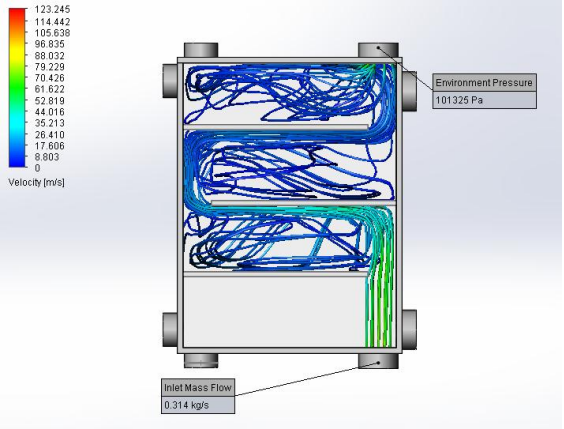

Fig.3.18. D inlet and G outlet

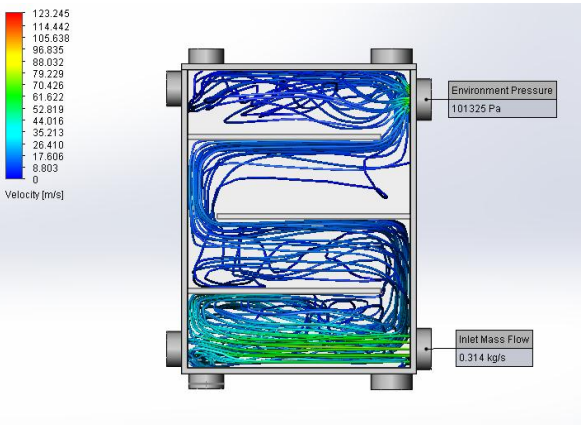

Fig.3.19. D inlet H outlet

TABLE.1. VELOCITY TABLE

S.NO	INLET	OUTLET	VELOCITY
1	A	E	173.497
2	A	F	173.798
3	A	G	127.199
4	A	H	127.630
5	B	E	183.797
6	B	F	173.698
7	B	G	127.151
8	B	H	125.337
9	C	E	173.733
10	C	F	175.602
11	C	G	112.557
12	C	H	117.451
13	D	E	173.660
14	D	F	174.324
15	D	G	112.998
16	D	H	118.090

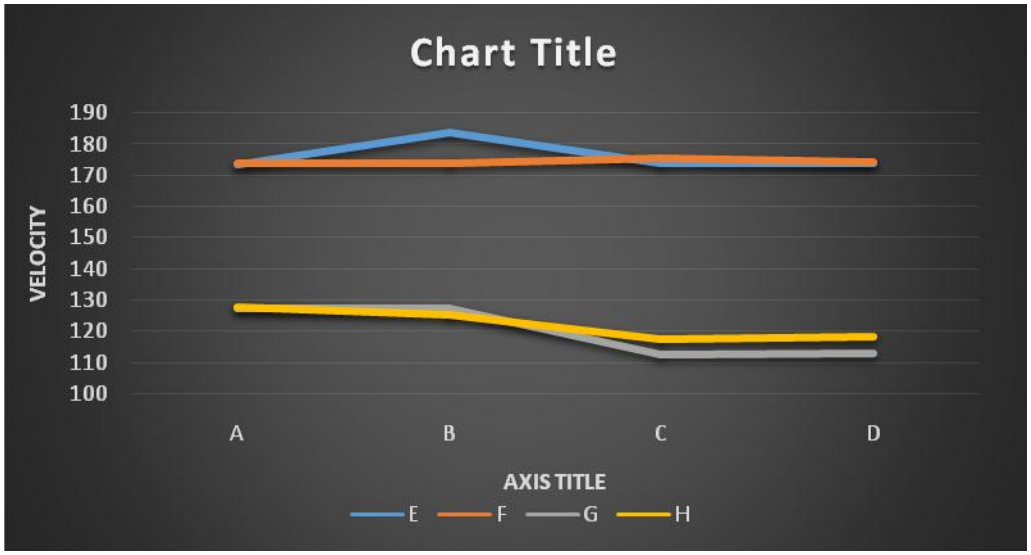

Fig.3.20 Velocity Chart

IV. RESULTS

The analysis of the air flow analysis of the solar heating chamber is done and the results were extracted. The main objective of the analysis is to find the probability of which combination of the inlet and outlet gives high area of air distribution inside the chamber. The results of the analysis are given in two aspects they are the structure which provides high area of air distribution inside the system and the structure which provides the high velocity. The combination which provides high area of the air distribution is the A-E inlet and outlet combination and the combination which provides high velocity outlet is B-E structure which provides 183.797 m/s at 0.314 kg/s mass flow rate under the atmospheric conditions. Thus the solar heating chamber is analysed for the air flow inside which provides the high area of air distribution and the velocity outlet which helps to determine which combination is best for the drying process

V. CONCLUSIONS & DISCUSSIONS

The holes for the inlet and outlet are angled perpendicular to the wall of the chamber the holes can be also angled in other aspects in order to perform the analysis for the future purposes.

The baffle plates are arranged in the zigzag pattern at the lengths of 400mm and the gaps between the baffle plates are kept at 150mm. This dimensional aspects can be changed to evaluate the air flow analysis

The mesh structure is dimensioned as 3mm in the analysis the size can be varied and the structures can be also changed for the analysis.

VI. REFERENCES

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