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Modified Atmosphere Packaging (MAP)

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SUMMARY

India is one of the top producer of agricultural commodities in the world. These commodities including cereals, pulses, fruits, vegetable, spices etc. The inappropriate handling and storage of post-harvest operations causes maximum losses in the country. These losses in terms of qualitative as well as quantitative, to overcome these problem modifies atmosphere packaging (MAP) exiting from the past decades. The MAP its name indicating to modify the atmosphere surrounding the commodity inside the packaging material. The gases such as CO2, O2 and N2concentrations are modified with the help of permeability of packaging material and respiration characteristics of commodity. Decreased the level of O2 and Increased the level of CO2 found greater enhancement in the shelf life of the food and better preservation of them in qualitative characteristics.

INTRODUCTION

Modified atmosphere packaging (MAP) is a secondary component of the food and food products startup. As its name indicates modification in atmospheric conditions. Atmosphere is having different composition of gases among that major gases considering such as oxygen (20.9%), carbon dioxide (0.03%) and nitrogen (78.1%) (Devlieghereet al., 2002). The composition of these gases are having linear relationship with many agricultural produce (cereals, pulses, fruits, vegetables, tuber crops, spices, oilseed etc.). after harvesting, the produces are continuously respired with environmental gases by consumption of oxygen and evolving carbon dioxide. Due to the respiration process, the oxygen internally reacts with quality parameters(carbohydrates, protein, fat, vitamin, mineral, bioactive compounds etc.) and degradation get start (Boonthanakornet al., 2020). Due to continuous degradation process, formation of poison gases evolved and resulted into reduced the shelf life of produce. The modified name often used to interchange the gases concentration levels, so the rate of respiration gets reduce and product enhanced their shelf life in terms of preserve the quality parameters in specific limit. Although modified names are used defined the enclosure of food products in gas barriers materials, inside that the composition of gases environment has been changes intentionally in order to inhibit spoilage and extend shelf life (Chmiel, et al., 2020). The technology has been commercial avaiabalbe since 1970s and nowadays MAP is intentionally used in worldwide to preserve the quality. The major objectives of the MAP are to extend the shelf life and to prevent undeniable changes in safety, sensory, nutritive and other qualitative value of foods. The achievement of the above mentioned objectives based on two principles, first is reduces unwanted physiological, chemical and physical changes in foods and second is, packaging technique to prevent product contamination. The present article discussed about basic principle of MAP, techniques involved, different methods, and industrial applications.,

Principles of MAP

As discussed before MAP is based on two principles to control the microbial growth and extend the shelf life of foods by maintain the environmental gases composition (O_2, CO_2 and N_2). The N2 is inert and tasteless gas it does not soluble in water but used to replace or displace the oxygen and prevent package collapse. O_2 promotes the growth of aerobic microorganism also its responsible for several undesirables' reactions in commodity consisting, oxidation and rancidity of fats and oils, rapid ripening, staling of bakery products, color changes. Hence the negative effect of oxygen on quality of product it has been intentionally kept less or negligible in the MAP. CO_2 is soluble in both water and lipids and their solubility increases with deceasing temperatures (Gaikwad et al., 2020). The increased concentration of CO_2 in MAP because of having some bacteriostatic effect and slow down the respiration or ripening process of many products. Due to individuals own specific negative as well as positive effect mechanism phenomenon, these three gases are modifying in their respective optimum level inside the packaging material. Sometimes, other gases have been used in combination with the above mentioned for example, carbon monoxide (CO), sulfur dioxide (SO_2) used to prevent oxidative browning and to control the growth of bacteria and molds. Fig 1 & 2 represent the principles of MAP and interaction of gases environment inside the package.

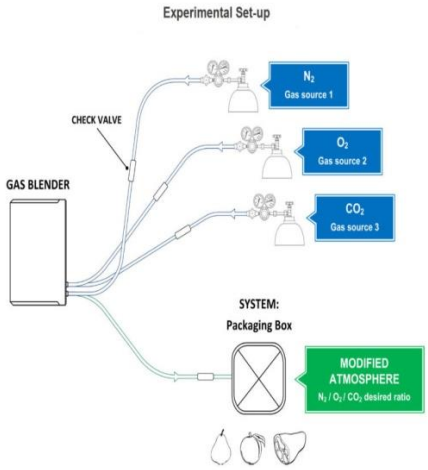

Fig.1 Principles of modified atmosphere packaging

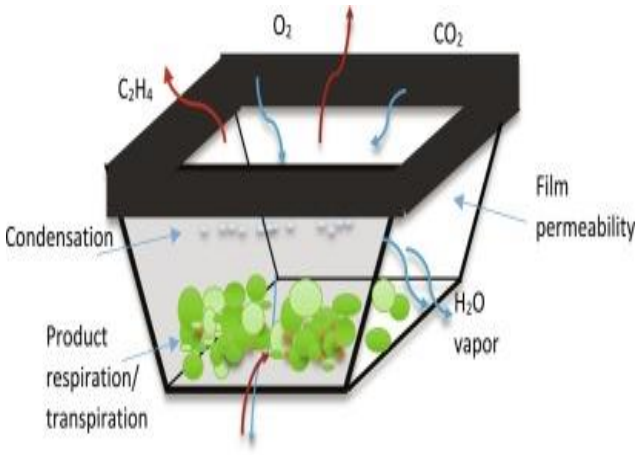

Fig 2. Interaction of gases environment inside the package for with food products

Gaseous Environment

The selection of gases and its concentration is majorly depending on the type and nature of product being packed. The following heading described about the gases

Carbon dioxide

- Colorlessgas with slight pungent odor, dissolves readily in water
- Antimicrobial activity increases up to 10 ºC temperature and above that its deeply decreased
- High solubility of CO_2 result in pack collapse.

Oxygen

- Colorless, odorless, highly reactive
- Low solubility in water and promotes different deterioration reactions in foods
- Most of bacteria and fungi required O_2 for growth

Nitrogen

- Non-reactive gases with colorless, tasteless and odorless, highly reactive and flammable
- Low solubility in water than organic solvents

Noble gases

- Consisting helium (He), argon (Ar), xenon (Xe) and neon (Ne) are inert
- With other combinationthat found beneficial effect on meat, fruits and vegetables.

Packaging Materials

The quality and shelf life of food in MAP is mainly depend upon the selection of most appropriate packaging materials. Nowadays flexible pouches, semi-rigid plastics and laminates are demanded for packaging materials in MAP. It should have goodselection properties like, ease of forming, light weight, good clarity, heat sealing and strength to suitable as food packaging. Mostly MAP(Leeet al., 2018)films are multilayer in formation and characteristics also develop by using co-extrusion, lamination, coating or combination technologies. The commonly used main plastics in MAP as listed in the following diagram (Fig. 3). The selection of the mentioned packaging materials has the following characteristics

- It should be food product approval
- It should have good gas and vapor barrier properties
- It should have good optical properties
- It should have strong mechanical properties
- Is should be ease in hat sealing properties

Advantages of MAP

- Increase the shelf life of food up to 400%
- Lowers the cost of products and provide long-distance export options
- It can extend the seasons of certain fruits and vegetable
- Without using chemical ideal for packaging of organic produce

Disadvantages of MAP

- It retards the growth of spoilage microbes but not slow down the growth of harmful bacteria
- Once the packages are open, the food has a normal shelf life

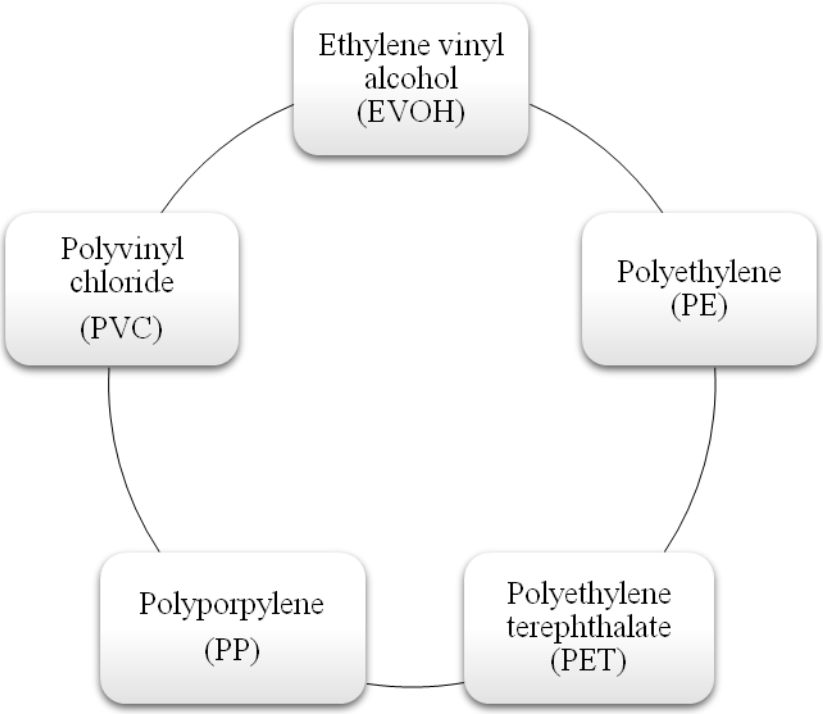

Fig. 3 Commonly used main plastics in MAP

Machines used in MAP

Horizontal form-fill-seal (HFFS). capable of making flexible pillow-pack pouches from only on e reel of film	Vertical form-fill-seal (VFFS). gas flushed packages are gravity fed by loose product which has been pre-weighted on a multihead weighter	Thermoform-fill-seal (TFFS). produces packages consist of thermoformed semi-rigid tray, which hearmatically sealed to flexible liding material	Vaccum chamber (VC).used comp-ensated vaccum technique to repla ce air. back flush-ing with desire gas mixture, hea-ting and sealing

CONCLUSION

MAP is responsible to extend the shelf life of food with better sensory quality and microbiological safety. The selection of packaging material is highly product specific. MAP will be becoming more common in small retail and catering establishment.

REFERENCES

Devlieghere, E, Gil, M. I. and Debevere, J. (2002). Modified atmosphere packaging (MAP). In: The Nutrition Handbook for Food Processors (C. J. K. Henry and C. Chapman, eds), pp. 342-370. CRC Press, Boca Raton, FL

Boonthanakorn, J., W. Daud, A. Aontee, and C. Wongs-Aree. (2020). Quality preservation of fresh-cut durian cv. 'Monthong' using micro-perforated PET/PE films. Food Packaging and Shelf Life, 23:100-104.

Chmiel, M., M. Roszko, E. HaćSzymańczuk, L. Adamczak, T. Florowski, D. Pietrzak, A. Ce giełka, and M. Bryła. (2020). Time evolution of microbiological quality and content of volatile compounds in chicken fillets packed using various techniques and stored under different conditions. Poultry Science 99 (2):16–26.

Gaikwad, K. K., S. Singh, and Y. S. Negi. (2020). Ethylene scavengers for active packaging of fresh food produce. Environmental Chemistry Letters 18 (2):269–316.

Lee, J. H., D. S. An, and D. S. Lee. (2018). Fresh produce container adaptively controlled in its atmosphere modification under variable temperature conditions. Biosystems Engineering 171:265–271.