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〈Special Artice〉

The Trend of Cigarette Design and Tobacco Flavor System Development

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ABSTRACT : In light of addressing consumer health concern, coping with anti-tobacco movement, and promoting new product, tobacco industry is actively pursuing to make a new generation of cigarettes with low tar and nicotine deliveries, and less harmful substances. Low tar and low nicotine cigarettes increases their market shares dramatically world wide, especially in KT&G, multinational tobacco companies, EU countries, even in China regulated by CNTC to set up yearly target to lower tar and nicotine deliveries. On the other hand, to design a new cigarette with reduced harmful substances begins to gain speed. The "modified Hoffmann list" publishes thirty plus substances in tobacco leaf and main smoke stream, which is the prime suspect causing health problems. Various ways and means are developed to reduce such components including new tobacco breeds, new curing method, tobacco leaf treatment before processing, selected filtration system, innovated casing system to reduce free radicals, as well as some non conventional cigarette products. In TSRC held this year, the main topic is related to reduce tobacco specific nitrosamines in tobacco leaf. The new generation of cigarette is in the horizon. It still needs a lot help to produce commercial products with satisfied taste and aroma characters. The flavor industry is not regulated by many governments demanding which ingredients might or might not be for tobacco use. However, most of the cigarette companies self impose a list of ingredients to guide flavor suppliers to design flavors. Unfortunately, the number of ingredients in those lists is getting shorter every year. It is understandable that the health is not the only reason. Some cigarette companies are playing safe to protect the company from potential lawsuit, while others are just copying from their competitors. Moreover, it is obvious that it needs more assistance from casings and flavors to design new generation of cigarettes with missing certain flavor components in tobacco leaf and main smoke stream. These flavor components are either non-existed or at lower level at new form of cured tobacco leaf or filtered in the main smoke stream along with reduced harmful substances. The use of carbon filters and other selected filtration system poses another tough task for flavor system design. Specific flavor components are missing from the smoke analysis data, which brings a notion of "carbon taste" and "dryness" of mouth feel. It is ever more demanded by cigarette industry to flavor suppliers to produce flavors as body enhancer, tobacco notes, salivating agents, harshness reducer, and various of aromatic notes provided they are safe to use. Another trend is that water based flavor or flavor with reduced ethanol as solvent is gaining popularity. It is preferred by some cigarette companies that the flavor is compounded with all natural ingredients or all ingredients should be GMO free. The new generation of cigarettes demands many ways of new thinking process. It is also vital for tobacco industry. It reflects the real needs for the consumers that the cigarette product should be safe to use as well as bearing the taste and aroma characters smokers always enjoyed. An effective tobacco flavor system is definitely a part of the equation.

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The global trend of tobacco industry is like trends of any other industries lead by consumer needs, benefited with new technology availability, affected by the global economy, and subjected for various rules and regulations. Anti-tobacco organizations and media exceptionally scrutinize cigarette, as a legal commercial product. Cigarette is probably the most studied commercial product for its composition, structure, deliveries, effects, as well as its new developmental trend. Therefore, any new trend of cigarette development would be within these boundaries. This paper is trying to point out what it would be like for tobacco industry in the next few years and what concerns the tobacco industry. It focuses mostly on the efforts to produce safer cigarettes. It is such a vital task for the tobacco industry and its affiliate industries such as cigarette papers, filters, flavors, and other materials. The facts and knowledge presented in this paper might be well known for the public. Some of the comments and predictions are very much personal opinion for a further discussion.

General Trend in Global Tobacco Industry

Further Merge, Acquisition, and Privatization

The biggest impact for the global tobacco industry for the last decades is the trend of global merge, acquisition, and privatization. The headlines for the global tobacco industry are the acquisition of RJR international by JT international, the merge of BAT and Rothmans, and the merge of Austria Tabak with Swedish Tobacco, the privatization of KT&G, and the consolidation of cigarette companies by CNTC in China. These activities explained the objectives of market domination and survival necessity. Further acquisitions, merges, privatizations, and consolidations are expected in this decade.

Cigarette Dealers, Cut Rag Business, and Maker-Packer Operations

One trend of the global tobacco industry is that cigarette companies are getting bigger, and the other trend of the global tobacco industry is that many smaller companies with diversified operations are emerged. These newly formed companies are not competing for the cigarette brand recognition, or the premium price cigarette segment, rather discount priced cigarette segment. The conventional cigarette companies are divided into three specialized companies. The first type of business deals with cigarette marketing and sales, the second one involves in tobacco leaf processing and flavoring, and the third one only takes care of cigarette making and packing. In real practices, these three types of business could be newly founded companies, or existing cigarette companies involved in a part of the operations. It is very effective, flexible, and consumer oriented segments of the cigarette industry. Any individual operation may not threat to the cigarette giant, but collectively, these types of business are formidable in the market place. It is obvious that these types of business bare a thin profit margin as well as low investment for the infrastructure.

Counterfeit Cigarette Business

This type of illegal business has been existed since standard commercial business ever formed. The higher the government taxes imposed to the tobacco industry, the more counterfeit cigarettes would be presented to the market. The ratio of the profit to the risk of running the underground business decides the size of the counterfeit market. The trend of counterfeit cigarette making is getting stronger. Cigarette taxes are in such a hike in all countries resulted in the huge profit margin for counterfeit cigarette making. With that much money available, the counterfeit cigarette dealers are becoming powerful and sophisticated to compete in their cigarette products in a sense of the quality of the authenticated cigarette products. The author of this paper has the opportunity to evaluate some counterfeit cigarettes worldwide comparing with the real products. The experiences of the comparisons could be anywhere from the counterfeit cigarettes being inferiors, no difference, and superiors to the genial ones. The balances have to be in consideration for

collecting more taxes from legal cigarette producers and for controlling counterfeit cigarette market so as not to losing taxes revenues for all governments. Another potential problem for the governments is the social instabilities brought by the black markets.

Anti-Tobacco Activities

The trend of anti-tobacco movement is not likely diminished for this decade irregardless of cigarette industry evolving itself to make the safer cigarettes intended by a few cigarette makers. Anti-tobacco activity is no longer a political movement or consumer health activist organization, but an industry derived from tobacco industry. Anti-tobacco organizations are literally funded by tobacco industry. There are so many activists are very genial to concern the adverse effects from smoking to the public health and willing to fight for it. These noble people might change their stands against tobacco industry in a lesser degree if, only if enough medical evidence indicating a new generation of cigarette products no longer posing gravel danger to the public health. There still are others whose livelihood is solely depending on the anti-tobacco activities. Tobacco industry will hear from their objections and be challenged with lawsuits as long as tobacco industry is still operating. One of the new claims is that tobacco industry intentionally misleads the public to produce low tar and low nicotine cigarette in order to sell more cigarette products because the smokers are likely buying and using more cigarette products to satisfy their nicotine hungers. This claim, as usual, is supported by some data that some consumers complain they have to smoke more cigarettes per day and cause more harms to their health as the consequences. Some formal cigarette company employee, as usual, also testifies this claim, that it is the deceiving plot to increase the profit. It is also the cigarette companies intention of inducing more young smokers for providing smooth, easy smoking low tar and low nicotine cigarettes as part of the claim. Tobacco industry historically takes little defense or no defense in the public arena with scientific research data. Therefore, the public opinion is never of their favor. The tobacco industry is always relying on lobbying the government support because of its contribution of the fiscal revenue. This trend is likely changed gradually, but unlikely changed for the short term.

Market Trend in Global Tobacco Industry

Low Tar, Low Nicotine Cigarette

Low tar and low nicotine cigarettes are gaining popularity from the consumers everywhere in the world. The average tar deliveries of the cigarettes various from market to market. The lowest average tar delivery of the cigarettes is probably at the Korea market. Japanese cigarette market is likely to be the second in that category. Both markets prefer their cigarette products with carbon filters in high percentages. Some efforts were observed in the Indonesia to lower the tar delivery in the hand making clove cigarettes. The Chinese cigarette industry receives the mandatory annual target for the maximum cigarette tar delivery allowed. The sources revealed that 15 mg is the highest cigarette tar delivery allowed by the end of the year 2002. The technology to produce the low tar and low nicotine cigarette is available readily. The trend is that all markets will embrace the low tar cigarette as the major players sooner or later. This is clearly an example that consumer choices are influenced and lead by producers. It is interesting to observe that some market has restrictions from the governments to label the cigarette with low or mild in order not to give smoker a wrong idea that theses cigarettes pose low risk or mild effect on health.

Low Price Cigarette

Lower production cost is one of the real measures of the profitability for any industry. Low cost cigarette does not necessarily related to low price cigarette, nor implied to the low quality

cigarettes. On the other hand, low priced cigarette production does not always bare low production cost. It is very easy to blur the lines. There are different ways to produce low priced cigarette, either by lower the production cost, smart cigarette design, reasonable leaf blends, or using inferior materials. The market share and consumer acceptance are the rulers for their success. There is no clear evidence to show the trend if the discounted priced cigarette segment increases its market share even with cut rag business being getting strong. Unfortunately, some premium priced cigarette brands are forced to lower the prices as the consequences of losing market share due to lower material cost and lower quality standard, not to competition. In Korean market, some encouraged signs to show new brands with premium price and high quality gaining consumer acceptance and market share. Smokers still prefer cigarette with good taste and aroma characters.

Safer Cigarette

In light of addressing smoker health concerns, coping with anti-tobacco claims, and promoting new products, the tobacco industry is actively pursuing to make the safer cigarettes with less harmful substances. Many research data available pin out the suspected chemical components and substances in the smoke as harmful to the health including the Modified Hoffmann List. These data are generated from almost all possible sources, government research institutions, anti-tobacco organizations, medical society, as well as tobacco industry. Tobacco industry successfully defended itself for many years from lawsuits, but it failed to do so in the last few years. It is time to re-thinking and acting to deal with the problem for its survival. After all, the tobacco industry does employ some many very talented scientists and researchers who might invent a new generation of the products, that would declare as safer cigarette. Signs and news of this type of cigarette were under the intensive research by various cigarette companies. A successful new product might dominate the cigarette market for the future.

Unconventional Cigarette

Other forms of or unconventional cigarette development are also under investigation for the possible substitution for the conventional cigarette. Multinational cigarette companies as PM and RJR already developed some models tested by consumers. The commercial versions of these products are yet to modified. However, numerous attempts to develop such products are under way by many others including major cigarette producers, tobacco industry affiliates, medical doctors, as well as self-employed inventers. The creativity of human being should never be under-estimated, especially the success of that type of invention directly related to the multi-billion dollar cigarette market.

Cigarette Design Trend in Global Tobacco Industry

Selected Filtration System

Most of the cigarette filters are made from cellulose acetate. Without the aid of filter ventilation, filtered cigarette normally reduce tar and nicotine from 40% to 50% comparing to unfiltered cigarette. The fibrous filter has the great efficiency selectively reducing particulates and some semi-volatiles in the vapor phase. The charcoal filter, on the other hand, enhances the removal of smoking constituents in the vapor phase selectively. In the US, cigarette with charcoal filters takes less than 2% of market share, while the cigarettes with charcoal filters are popular in the Japan and Korea markets. The charcoal itself does not contribute so called charcoal taste ; it is what missing from the smoke causes such chalky and dry sensations. The advantages of the charcoal filters lay on the strong selectivity for removal of low molecular weight volatiles and semi-volatiles. Some of the low molecular weight aldehydes such as formaldehyde and acrolein are claimed to have adverse effects for the health. The disadvantage of the charcoal filters happen to the removal of the flavor materials in the vapor phase. More sophisticated charcoal filters and other highly

selective filter system might be the trend of the global tobacco industry for further reducing known harmful substance in the smoke stream.

Tobacco Breeding, Curing, Blending, and Engineering

Tobacco breeding program historically is designed to assist tobacco farmers to have new tobacco seeds available with high yield, disease resistance, and better maturity characters. The trend of new tobacco breeding program aims at creating tobacco types with reduced some harmful substances. The Flue-cured and the Oriental tobaccos naturally have less tobacco specific nitrosamines. It might be possible genetically to introduce new genes or shut down some genes that are responsible for the formation of tobacco specific nitrosamines. The application of the fertilizers and pesticides also brings the new attentions for the new tasks of reducing harmful substances in tobacco leaf.

Studies show that the concentration of tobacco specific nitrosamines is increased in the flue-cured processing use direct-fired burner. The by-product of the liquid propane gas such as nitrides and other oxides of nitrogen react with alkaloids in the tobacco leaf to form the tobacco specific nitrosamines. Heat exchange curing process precludes the exposure of the combustion gases and by-products onto tobacco, therefore eliminating the major sources of tobacco specific nitrosamines formation. It is foreseeable that the heat exchange method would replace the use of direct-fired burners. Burley type tobaccos naturally contain higher concentration of tobacco specific nitrosamines than flue-cued tobacco due to the heavy application of nitrogen fertilizer. The formation of tobacco specific nitrosamines in the air-cued process is likely due to the microbial activity. Shorten the curing times might reduce TSNA amount.

Cigarette blending used to be an art for achieving the best possible tobacco taste and aroma. Leaf blenders nowadays have to consider many aspects, such as cost, availability, tobacco origin, leaf chemistry, target of tar delivery, filling capacity, and last but not least, targeted consumers taste preference. It just adds one more parameter for leaf blenders, less harmful substances in the blends. With better understanding of the tobacco chemistry and more sophisticated analytical instruments, leaf blenders could timely determine what is the lowest level of the total harmful substances in the blends. Then, cigarette design specialist could use other means to further reduce those adverse substances in the smoke stream.

Tobacco by-products utilization was probably a revolution for tobacco industry. It serves multiple purposes as reducing the cost, fully utilizing all parts of tobacco leaf including tobacco dust, adjusting filling capacity, stabilizing cigarette brand taste characters, and creating more job opportunities. It is the successful engineering achievements to invent those expanded leaf and stem, and various forms of re-constituted tobacco sheets. Especially for the making of some re-constituted tobacco, physical and chemical changes happen at the same time. The author believes there is an attractive possibility to create a new form of cigarette with all components treated through physical and chemical engineering process to lower the harmful substances to the minimum while still maintain enjoyable taste and aroma character.

Chemical Treatment of Tobacco

Many trials and experiments are made to treat tobacco chemically at the various stage of cigarette making. The purposes of the treatment are various. Burn additive is probably the most commonly used practice. Some attempts are made to accelerating the aging process of tobaccos. Some commercial products are available to control tobacco bugs and microbial activities in the tobacco warehouse. There is also a report claiming by adding a chemical solution to tobacco leading to reduce free radicals in the smoke stream. It is likely this line of experiment will be carried on for some time trying to reduce harmful substances in tobacco by applying chemicals at

different stages of cigarette growing, aging, leaf processing, and cigarette making.

Herbal Cigarettes

Some smokers appreciate herbal cigarettes of various types. It is restricted to claim that the herbal cigarette has medical benefits the same as these herbs normally administered for medical purpose. However, it never stops those smokers believe that it might have a similar effect as medicine or at least healthier than regular cigarettes. Clove cigarettes were originally sold at the local Indonesia medicine shops. It was used to relieve respiratory pain. It is considered as one of the greatest invention by Indonesian to represent their culture. Chinese Ginseng is mainly grown in Jilin Province. Naturally, one of the most popular cigarettes in 80s was brand Ginseng produced in ChangChun Cigarette factory. The herbal cigarette production is sporadic and not very significant as for market shares, and may not be a trend globally, but it couldnt be ruled out for some regions and countries.

Flavor development Trend for Global Tobacco Industry

Dilemma

Tobacco flavor industry as a supporting industry faces the same restraint as tobacco industry indirectly. To be more responsible to the cigarette products, cigarette companies make lists of chemical ingredients allowed for the flavor compositions. The number of ingredients on the list various from company to company based on their understanding for what would be the safe chemicals and levels. It does not mean that the all chemicals not on the list are harmful for the cigarette products, but may be questionable. These positive ingredient lists could be viewed on the Internet, and they are all getting shorter by days. On the other hand, the tobacco industry needs better, and more effective flavors than ever. The demands for flavors with tobacco notes, salivating agent, and harshness reducer are higher. With all the emphasis on reducing harmful substance in tobacco products, many flavor materials in tobacco are removed at the same time as consequences. They are the casualties of the war. It is obvious that without an effective flavor system, the cigarette will not have the same taste and aroma characters that smokers always enjoy. Therefore, the tobacco flavorists have to understand what is missing from new tobacco breeds, new curing methods, new filtration system, and new forms of cigarette blends. They have to design and create new flavor system or building blocks with ever decreasing chemicals allowed to use. That is the dilemma facing the tobacco flavor industry.

All Natural Ingredients and GMO Free Ingredients

Some cigarette companies prefer the flavor system using all natural ingredients, while others demands that all ingredients in the flavor system should be GMO free. These requirements facilitate the flavor companies being more flexible, better management of the raw material inventory, and extra responsibility to certify raw material suppliers. However, without a strong medical evidence suggesting that all natural ingredients or GMO free ingredients perform safer than synthetic material, and without clear indication that market share positively correlates these specific requirements, it is hard to imaging that cigarette companies are willing to increase the flavoring costs to keep these requirements. This new trend is therefore questionable.

Long-Term Partnership

A few major flavor companies got out the tobacco flavor business to concentrate on the food flavor and fragrance business in the last decades. Some of the tobacco flavor companies also reduce their tobacco flavor operation scale as well as research activities in fearing the future of tobacco industry. These decisions must be carefully discussed by those companies and justified by their corporate business interests. As consequences, tobacco industry is re-evaluate the flavor suppliers seeking new alliance and

long-term partnership. It is not only ensuring the continuity of the same quality flavor supply, but also trusting that the research efforts will be carried on for the changing tobacco industry. Tobacco Technology, Inc. will firmly stand up with tobacco industry and make all her effort to win the trust and long-term partnership.

Solvent Issues

Flavors with water based solvent system or flavors with reduced ethanol as solvent are gaining popularity. The shipping of hazardous materials is getting stricter by all carriers. The reform of the after cut or top flavors may be triggered by such shipping restriction. The storage of less flammable liquid is also desirable for site managers of cigarette manufactures.

Conclusion

Tobacco industry is a changing industry to recognize the needs and duties for the consumers. The new challenge of producing a consumer friendly product relates to her future. It is not easy task and involves so many aspects of technology. Keep informed and open minded are the keys for the success.