	籍貫：江西省玉山縣許家村 國籍：中華民國 許鍾屏化學博士	<p> JP Hsu, PhD, Organic Chemistry Washington University, St. Louis, MO www.SmartChemistry.com Jphsu@SmartChemistry.com </p>
---	------------------------------------	--

Health Filter

Health cigarette filter is patented technology with USA Patent Number 6273095 and China Patent Number ZL 00 1 02348.9. The usage of Health Filter is disallowed without authorization.

J. P. Hsu

Health filter is a cigarette filter to selectively remove more carcinogens and toxic compounds than the regular cigarette filter, however, keep nicotine and cigarette taste.

Health Filter Preparation

Health filter is made from polyurethane foam from the following origin.

Foamex: 1500 East Second Street, Eddystone, PA 19022.

The description of Foamex on this polyurethane is

Grade: SIF/Z

Description: 6# Ultrafine

Pore Size: 110

Author: SR1267

I.D. #: 71421, White

Manufacture

1. Dip a sheet of Foamex polyurethane with 1 inch thickness into reagent grade water.
2. Install an approximate 4 inch long stainless steel tube with $\frac{3}{8}$ inch OD in an drill machine. The tip of the tube is sharpened so that the rotating tube can easily penetrate through the polyurethane foam (PUF).

3. Remove from inside the tube the PUF plug, which is then air dried.
4. The impurities on the PUF plug must be removed by organic solvent, which is performed by Soxhlet extraction of the PUF plugs using 10% ethyl ether, acetone or acetonitrile in hexane for 24 hours.
5. The solvent on PUF plug is then blown away by organic free nitrogen or air.

Verification

In addition to the experimental verification listed in the patent, a series of experiments have been performed recently to compare Health cigarette filter with regular cigarette filter using Marlboro, and three Chinese famous cigarette brands, Hongjinlong, Huanghelow and Hongtashen with the sampling and analytical methods below. The analytical results are listed in Table 1 to 4. For third party confirmation, we have asked Wuhan Tobacco Company to perform the same type of comparison using international methods adopted by Tobacco companies around the world. The report of Wuhan Tobacco Company is listed in Appendix I.

Sampling and Analytical method

In the experiment, a cigarette is lit and the smoke pumped continuously through a 15mL impinger cooled by liquid nitrogen (-196°C), as shown in Figure 1. The sampling is stopped just before burning the cigarette to its filter. The liquid nitrogen is then removed and the impinger warmed up to the room temperature. An aliquot of 5mL of acetone is added into impinger slowly so as to dissolve all cigarette residues trapped in the impinger. One mL of the acetone solution is added an internal standards for GC/MS analysis and the other four mL of acetone added to a weighed aluminum pan, which is heated on a 100°C hotplate for 24 hours. The aluminum pan is weighed again to obtain the weight of tar. For testing with Health Cigarette filter, a regular cigarette filter is pulled out and replaced in the same slot with a Health Cigarette Filter. Both types of cigarette filters are compared using the same package of cigarette.

Conclusion

We conclude from Tables 1 to 4 and report of Wuhan Tobacco Company on Health Cigarette filter that Health cigarette filter indeed can reduce significant amount of carcinogen and toxic compounds in cigarette smoke, however, keep approximate the same amount of nicotine and cigarette taste.

The Health Cigarette Filter impacts human health much less than regular cigarette filter. It is probably the best interest of US Tobacco companies to adopt Health Cigarette Filter. In addition, the use of Health Cigarette Filter will have

- No alteration of any production equipment,
- Probably lower cost of Health Cigarette Filter than regular cigarette filter since wood fiber for regular cigarette must be undergone chemical treatment of woods and Health Cigarette Filter is polymer, which is easily produced, and treatment has been designed to be efficient and environmental sound.

Figure 1: Sampling of Cigarette Smoke

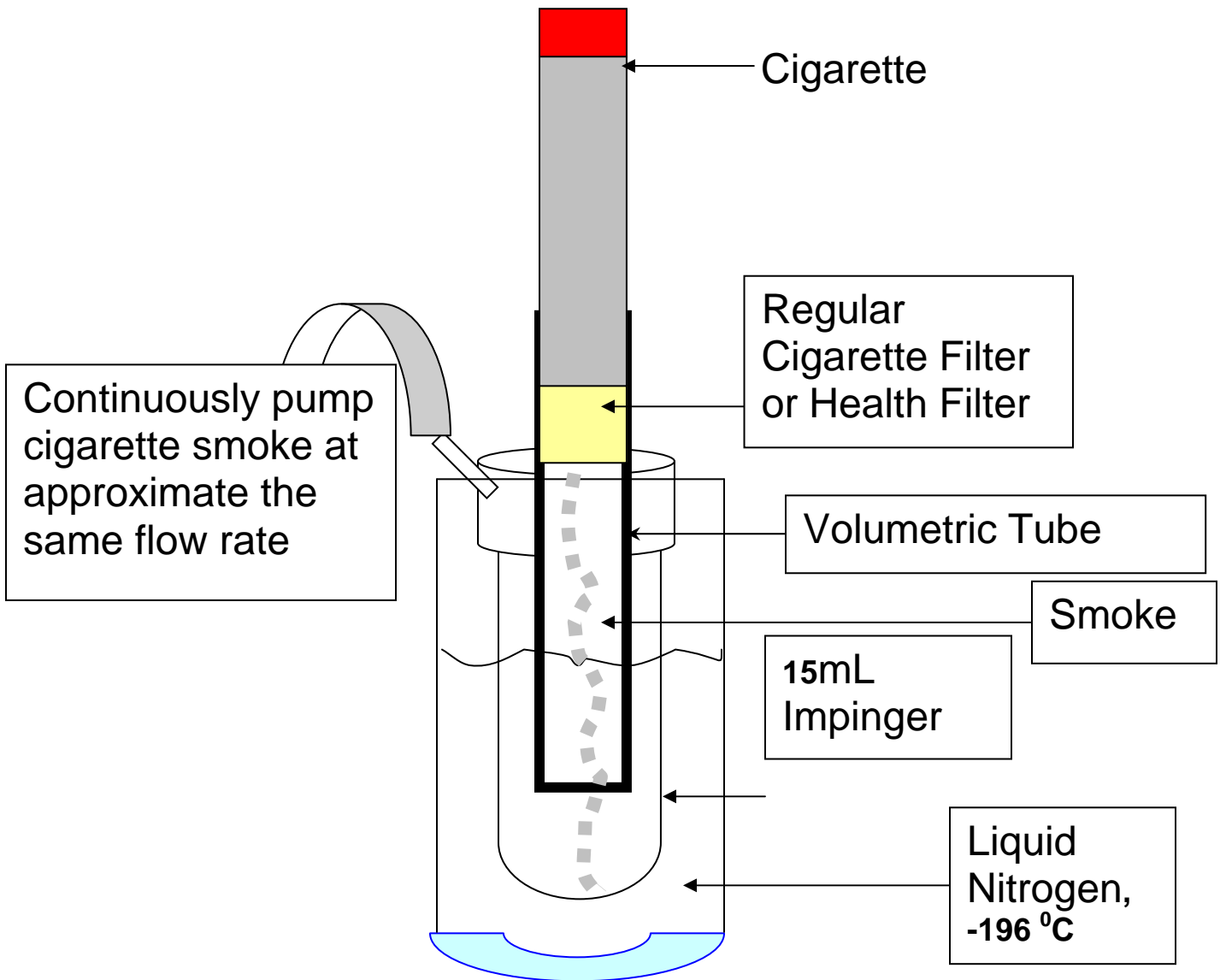


Table 1: Comparison of Health and Regular Cigarette Filters Using Marlboro

Brand: Marlboro	Marlboro Using Regular Cigarette Filter*		Marlboro Using Health Cigarette Filter**		Health Filter Compared with Regular Filter	
	Average	Standard Deviation	Average	Standard Deviation	% Reduced	% Increased
Tar (mg/Cigarette)	12	19%	12	44%		
Naphthalene*** (µg/Cigarette)	1.3	19%	0.18	41%	94%	
2-Methyl Naphthalene (µg/Cigarette)	1.5	34%	0.14		91%	
Phenol (µg/Cigarette)	31	27%	2.3	113%	93%	
2-Methyl Phenol (µg/Cigarette)	6.9	20%	0		100%	
4-Methyl Phenol (µg/Cigarette)	17	6.8%	2.8	49%	84%	
Nicotine (mg/Cigarette)	1900	11%	1956	5%		3%

* Three
Cigarettes

** Six
Cigarettes

*** As of Sept. 1998, EPA added a verified oral dose for naphthalene is 20 µg /kg/day and an inhalation unit risk of 3 µg /M³ (**Appendix II**).

Table 2: Comparison of Health and Regular Cigarette Filters Using Honjinlong

Brand: Hongjinlong	Hongjinlong 紅金龍 Using Regular Cigarette Filter*		Hongjinlong 紅金龍 Using Health Cigarette Filter**		Health Cigarette Filter Compared with Regular Cigarette Filter	
	Average	Standard Deviation	Average	Standard Deviation	% Reduced	% Increased
Tar (mg/Cigarette)	9.2	43%	8.9	31%	3%	
Naphthalene*** (µg/Cigarette)	2.8	21%	0.34	27%	88%	
2-Methyl Naphthalene (µg/Cigarette)	3.0	40%	0.65	60%	78%	
Phenol (µg/Cigarette)	39	44%	14	60%	64%	
2-Methyl Phenol (µg/Cigarette)	8.9	35%	2.8	54%	69%	
4-Methyl Phenol (µg/Cigarette)	21	34%	10	56%	52%	
Nicotine (mg/Cigarette)	954	18%	1159	21%		21%

*Ten Cigarettes

**Eight Cigarettes

*** As of Sept. 1998, EPA added a verified oral dose for naphthalene is 20 µg /kg/day and an inhalation unit risk of 3 µg /M³ (**Appendix II**).

Table 3: Comparison of Health and Regular Cigarette Filters Using Huanghelow

Brand: Huanghelow	Huanghelow 黃鶴樓 Using Regular Cigarette Filter*		Huanghelow 黃鶴樓 Using Health Cigarette Filter**		Health Cigarette Filter Compared with Regular Cigarette Filter	
	Average	Standard Deviation	Average	Standard Deviation	% Reduced	% Increased
Tar (mg/Cigarette)	13	48%	13	32%		
Naphthalene*** (µg/Cigarette)	4.7	36%	0.50	96%	89%	
2-Methyl Naphthalene (µg/Cigarette)	4.6	41%	1.6	58%	65%	
Phenol (µg/Cigarette)	47	34%	8.1	82%	83%	
2-Methyl Phenol (µg/Cigarette)	11	43%	2.2	59%	80%	
4-Methyl Phenol (µg/Cigarette)	24	19%	10	58%	58%	
Nicotine (mg/Cigarette)	1257	15%	1441	30%		15%

*Four Cigarettes

**Nine Cigarettes

*** As of Sept. 1998, EPA added a verified oral dose for naphthalene is 20 µg /kg/day and an inhalation unit risk of 3 µg /M³ (**Appendix II**).

Table 4: Comparison of Health and Regular Cigarette Filters Using Hongtashen

Brand: Hongtashen	Hongtashen 紅塔山 Using Regular Cigarette Filter*		Hongtashen 紅塔山 Using Health Cigarette Filter**		Health Cigarette Filter Compared with Regular Cigarette Filter	
	Average	Standard Deviation	Average	Standard Deviation	% Reduced	% Increased
Tar (mg/Cigarette)	11	16%	10	36%	9.1%	
Naphthalene*** (µg/Cigarette)	3.6	20%	0.41	49%	89%	
Phenol (µg/Cigarette)	34	50%	3.6	82%	89%	
2-Methyl Phenol (µg/Cigarette)	10	51%	1.0	43%	90%	
4-Methyl Phenol (µg/Cigarette)	12	48%	1.7	48%	86%	
Nicotine (mg/Cigarette)	656	23%	609	32%	7%	

*Four
Cigarettes

**Five
Cigarettes

*** As of Sept. 1998, EPA added a verified oral dose for naphthalene is 20 µg /kg/day and an inhalation unit risk of 3 µg /M³ (Appendix II).

Appendix I

Wuhan Tobacco Company Report on Health Filter

Dr. Yi-Kun Chen, Research Scientist, Research Center, Wuhan Tobacco Company

We have performed a series of experiments to compare acetate cigarette filter* and Health Cigarette filter and the results are tabulated below. From the experimental results below, the Health Filter can obviously reduce more toxic and carcinogen compounds than acetate filter, however, tar is not reduced. In addition, the cigarette taste using Health Cigarette filter is the same as that of acetate cigarette filter.

Sample	Tar mg/cigarette	Water mg/cigarette	Pressure Drop Due to Filter (Pa/filter)	Nicotine mg/cigarette	Phenol µg/cigarette	Methyl Phenols µg/cigarette	Naphthalene µg/cigarette
Hongjinlong with Acetate Filter	15.23	2.846	1170	1.257	3.6 (SDE*)	7.1 (SDE*)	1.2 (SDE*)
Hongjinlong with Health Filter	15.69	3.108	1180	1.268	2.1 (SDE*)	3.6 (SDE*)	Not Found
Huanghelow with Acetate Filter	15.70	2.148	Not Measured	1.260	4.8	11	
Huanghelow with Health Filter	16.13	2.250	Not Measured	1.354	Not Found	Not Found	

*SDE – Simultaneous distillation and extraction. The analytical results obtained by SDE are used for the purpose of comparison only, not the real values.

** The weight of acetate filter is 1.02 g per filter and that of Health Filter 1.28 g/filter.

- Acetate cigarette filter is regular cigarette filter invented by Eastman Kodak and used for at least thirty or forty years. It is made of wood fiber and glued together by triacetate glycerol. Therefore, it is called acetate filter. Each cigarette filter contains approximate 20,000 wood fibers and 0.55mg of triacetate glycerol. The wood filters were packed together in the shape of a large cubic with side length approximate 2 meters. The cigarette machine takes a string of fibers with approximate 20,000 fibers, sprays triacetate glycerol onto the fibers, centers all the fibers into a current cigarette OD (0.8cm), wraps the circular glued wood fiber with cigarette paper and cut it at the speed of approximate 4000 times per minute to 12-cm filter rod. The cigarette rods are then transferred through a long tube to a cigarette-assembling machine. This machine combine from both ends of a filter rod with tobacco and wrap tobacco and 2 cm of the end of the filter rod. A knife cuts the end of the 2-cm at filter side. In this way, a 12-cm filter rod requires three time of cutting to make 6 cigarettes. In this way, a cigarette machine can make 12,000 cigarettes per minute. Therefore, the hardness of filter is quite important to facilitate the transferring and cutting processes.

- The test performed by Dr. Chen was done using a smoking machine made by Germany. Each test used twenty cigarettes. The sampling rate of smoking machine is at 30 mL/sec for 2 seconds through lighted cigarettes, idle another 10 seconds and this sampling circle repeats over and over until the whole cigarette was burned.