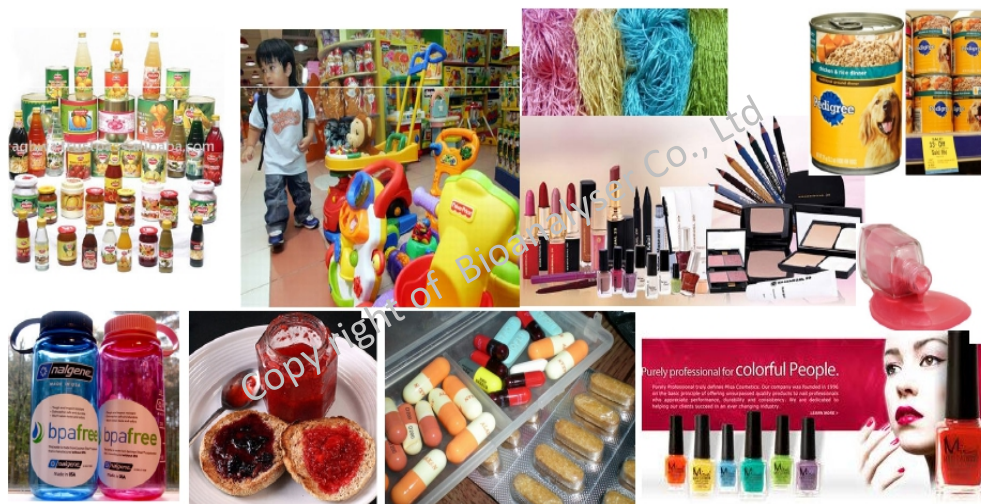


# Portable Real-Time Organic Compound Toxic Detector with chemosensor reagent

Presented by  
Francis Leung, Bioanalyser Co., Ltd  
Sept 2018

# Business Problems in Global Supply-Chain Industry

- Due to be over limit of **phthalate or plasticizer substances** can cause Carcinogenesis, Mutation or Reproductive (CMR) diseases, consumer products safety regulations in different countries set limitation of those organic compound strictly to be used in the consumer product and shall be tested before delivering to the market of import countries.
- Phthalate/Plasticizer shall be strictly not be over 0.1ppm to exist in food or food contact product and cosmetics; not over 1000ppm of various phthalates in toys, children and infant articles, etc., according to Product Safety Regulation of US CPSC and EU REACH Directive globally.
- **Due to be very expensive of total cost of building up in-house chemical laboratory need to spend for RMB 2 Million in which included GC-MS, nitrogen gas, laboratory hardware setting, etc. (Please see lower right-hand side photo)**
- **So that develop a cost-effective and real-time organic compound detector but its test result is highly similar to the test result of HPLC or GC-MS used in 3<sup>rd</sup> party laboratory.**

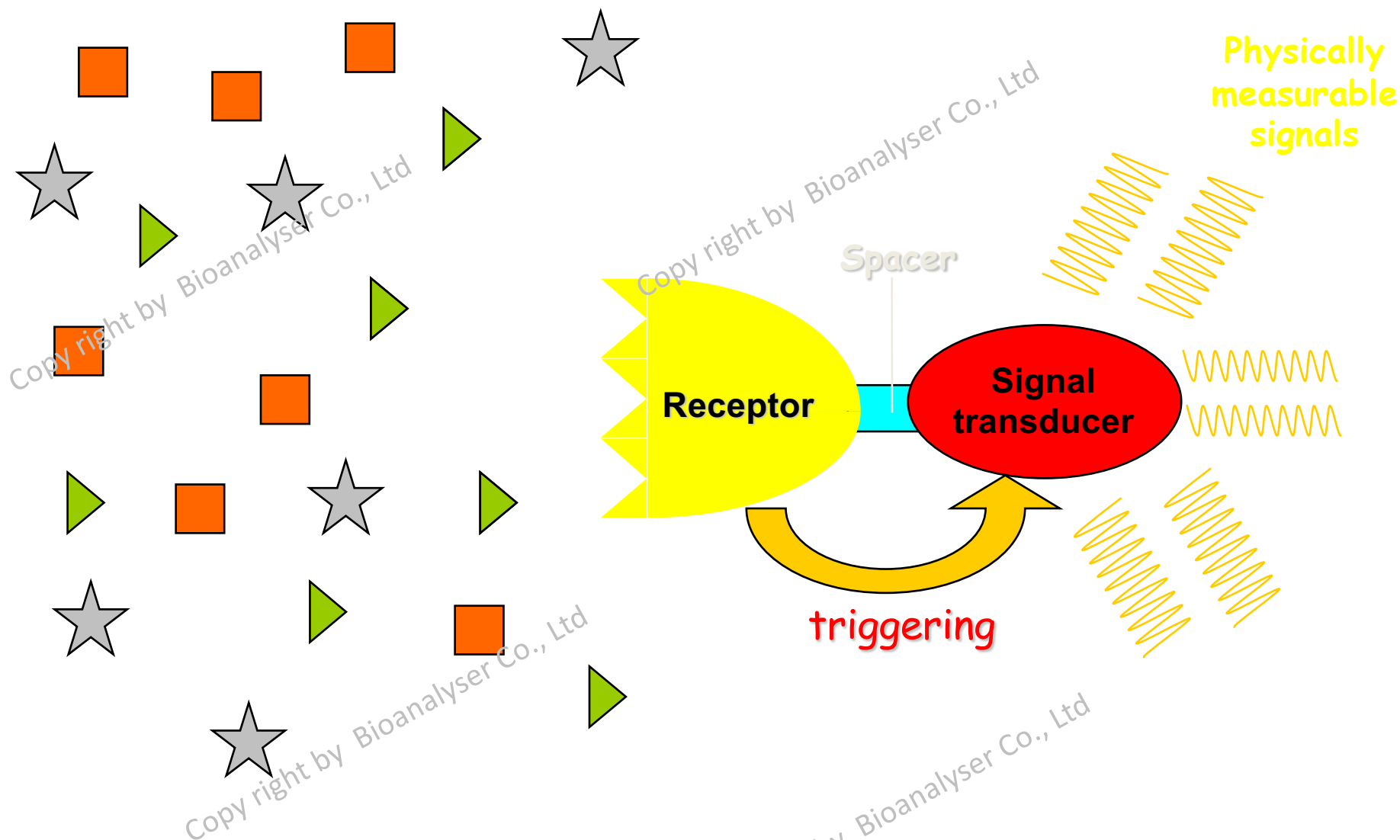


## Agilent 5975C Series GC/MSD



### Performance, productivity and confidence.

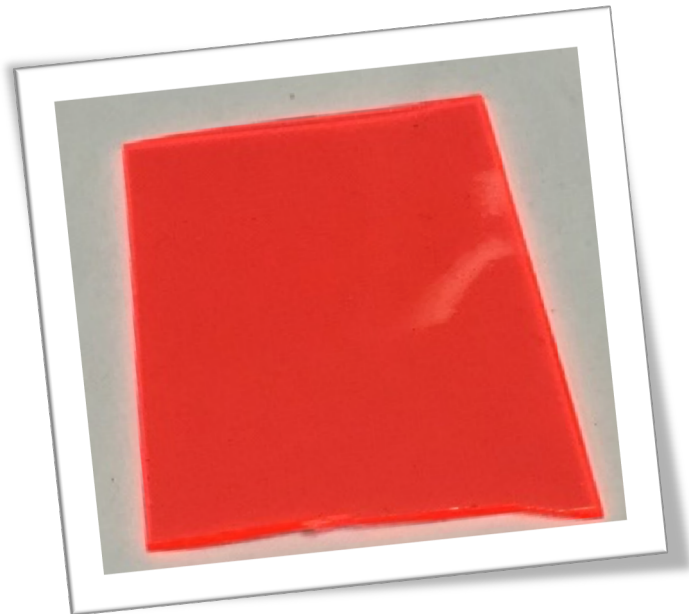
Welcome to the next generation of the industry-proven Agilent 5975 Series MSD — the most popular GC/MS of all time. The Agilent 5975C inert MSD with its Triple-Axis Detector gives you innovative design features to boost your lab's productivity and advanced analytical capabilities that enhance your results—and your confidence. In addition to delivering better MS resolution and the lowest mass deviation available, the system offers superior sensitivity and spectral integrity. Advanced analysis routines let you get more information from every run, and the latest version of automated spectral deconvolution, identification, and quantification software provides higher quality analyses with even less operator time and attention. [More.](#)



- ❖ Chemosensors of Molecular Imprinted Polymer are molecular devices able to selectively recognize and reversibly bind targeted molecular entities and yield measurable signals. However, plenty of limitations hinder the application of chemosensors in the real-world.

## Screening test for phthalates in plastic materials

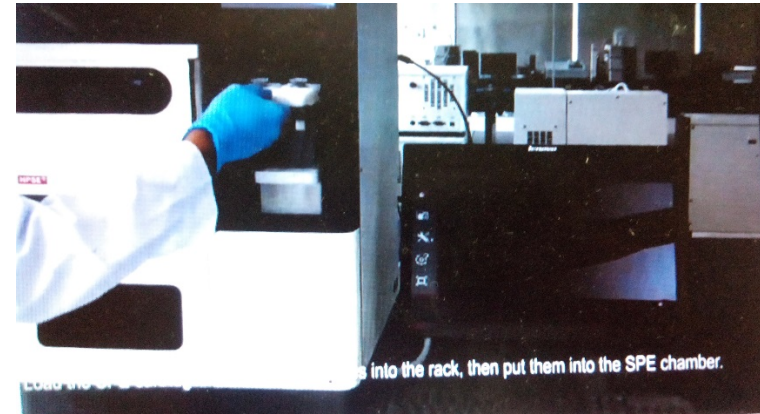
1. To determine the content of phthalates in the PVC sample provided by SGS using a traditional GC-MS method (CPSC-CH-C1001-09.3) for blind test (Due Diligence);
2. To verify the recovery of phthalates when ethanol is used in the extraction processes other than conventional extraction method in CPSC-CH-C1001-09.3;
3. To compare the differences between GC-MS determination and our novel MIP chemosensor-based screening test method.



A PVC sample supplied by a local HOKLAS accredited testing laboratory with known phthalate content as a reference material



# Conventional Automatic Extraction Method



# Comparison of Test Results between GC-MS determination and Molecular Imprinted Polymer

Determined via traditional established method CPSC-CH-C1001-09.3:

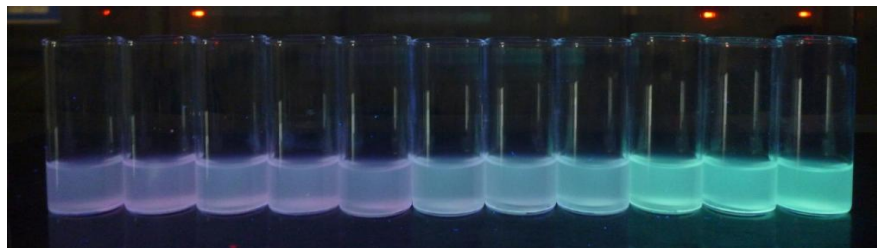
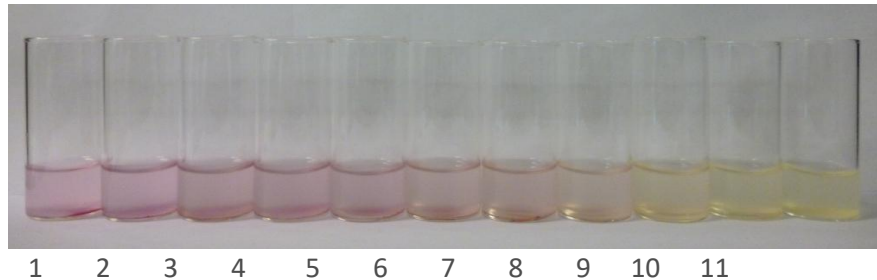
Extraction method is conventional heating in vessel with THF

1. DEHP, %(w/w) : 0.67;
2. DINP, %(w/w) : 0.34;
3. DnOP, %(w/w) : 18.5.

Our extraction method with ethanol is microwave digestion for 15 minute

Determined via *in-house* ethanol extraction\* adopted for chemosensing by Molecular Imprinted Polymer (MIP):

1. DEHP, %(w/w) : 0.57;
2. DINP, %(w/w) : 0.30;
3. DnOP, %(w/w) : 17.1.



DEHP in ethanol concentration: (1) 0  $\mu\text{M}$ ; (2) 2  $\mu\text{M}$ =0.7ppm; (3) 6  $\mu\text{M}$ ; (4) 10  $\mu\text{M}$ ; (5) 20  $\mu\text{M}$ ; (6) 60  $\mu\text{M}$ ; (7) 100  $\mu\text{M}$ ; (8) 200  $\mu\text{M}$ ; (9) 600  $\mu\text{M}$ ; (10) 1 mM; (11) 2 mM=800ppm .

# Advantages of Molecular Imprinted Technology

Advantages of Extraction for the novel MIP detection on phthalates or other organic substances:

- 1) Only need 10-15 minutes for extraction using ethanol solvent, if adopting general heater and pressurized vessel.
- 2) If adopting mini microwave for extraction, just need 15 minutes.
- 3) No harmful solvent for the operator, who has not chemistry training.
- 4) This novel extraction method can be conducted by onsite service

Advantages of this rapid MIP detection:

- 1) Only need to detect phthalates within 1-5 minutes for quantitative analysis
- 2) This real-time portable MIP chemosensor with optical instrument can be conducted by onsite detection
- 3) The test result can be transferred to cloud database service for retailer program or manufacturer supply-chain quality management program for your inspection team.

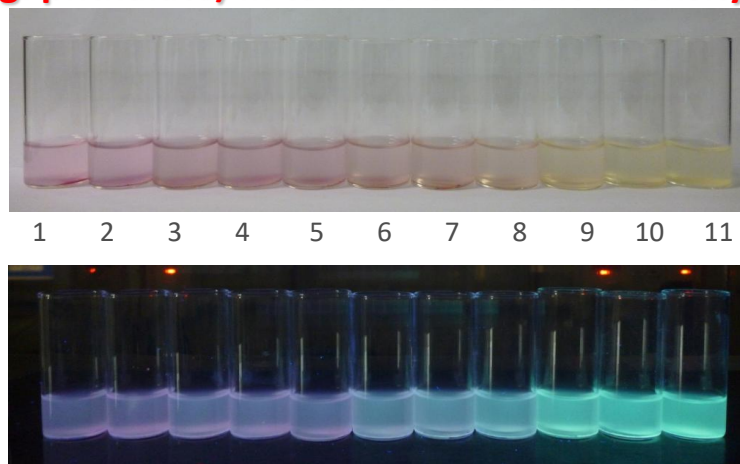


# Project Introduction

- ❖ This project will focus on developing a functional prototype of mobile detector and micro-extractor shown below figure
- ❖ Our chemical reagent can be produced by ourselves internally and then coat the reagent onto the glass chip for inserting it into the mobile detector for measurement.



**The concentration of target analytes (e.g. phthalate) in term of different intensity of colour magnitude, which can be down to 1ppm (2 $\mu$ M)**



DEHP in ethanol concentration: (1) 0  $\mu$ M; (2) 2  $\mu$ M=0.7ppm; (3) 6  $\mu$ M; (4) 10  $\mu$ M; (5) 20  $\mu$ M; (6) 60  $\mu$ M; (7) 100  $\mu$ M; (8) 200  $\mu$ M; (9) 600  $\mu$ M; (10) 1 mM; (11) 2 mM=800ppm .



# Competitive Advantages

## Advantageous features of Real-Time Organic Compound Detector with chemosensor reagent

- ❖ support onsite supply-chain quality control and testing by using real-time *in-situ* measurement and non-destructive analysis
- ❖ non-demanding on sample volume
- ❖ No need to build up in-house chemical laboratory and low operating cost
- ❖ low technical requirement from operators
- ❖ rapid analysis and able to provide real-time responses
- ease of miniaturization

## Team Profile

- ❖ Research team of local university and our core members have fully experience in developing cutting-edge lab-on-a-chip technology for the application of novel screening test method for global supply-chain industry and 3<sup>rd</sup> party laboratory service industry
- ❖ CTO and Managing Director had educated in research-based master program in the development of nanotechnology and microfabrication, especially focus on Lab-on-a-chip technology for biomedical IVD device; besides, he knows how to develop software program, firmware, integration of a complete sensing device, etc., due to his education background of BSc in Computer Science, MSc in Nanotechnology, MSc in Biomedical Engineering
- ❖ My working experience of quality and engineering in consumer products mfg, 3<sup>rd</sup> party lab and OBM US Inc. over 17 years
- ❖ My Marketing Director had working experience over 15 years in trading business

## Technical Challenge

- ❖ Lack of support on applying US ASTM and European EN standard of a novel test method from ITC of HK Government for our invention;
- ❖ Lack of free-of-charge service of using chemical lab and instrument, because we need to conduct test with GC-MS or HPLC for comparing the test result with our invention for the evidence for the application of a new ISO test method standard;
- ❖ Lack of independently governmental finance support on our prototype production and promotion on the application rather than ESS 50%-50%; as an owner and inventor has not income and is facing investors who do not have investment attitude for supporting our invention for long-term business and profit. They do intently earn quick money by reselling the investment.
- ❖ Lack of financial support on the novel technological training introduced to Hong Kong from US, EU and Israel Universities by HK Innovative and Technological Bureau, ITC and HK Government

## Target Marketing Segments

- ❖ SME factories (Upper stream of supply-chain) e.g. Toys factories, Cosmetics factories, etc.
- ❖ Global retailers (Down stream of supply-chain) e.g. Tesco, Carrefour, Walmart, etc.
- ❖ Global buying Office and trading companies of consumer products
- ❖ International commercial 3<sup>rd</sup> Party Laboratories and Government chemical laboratory
- ❖ Government sector e.g. Custom, consumer products safety section
- ❖ Universities, School, NGOs

# Marketing Strategy

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- ❖ Our business model based on marketing strategy to deploy a global licensing to the right manufacturer, international 3<sup>rd</sup> party laboratory and government sector firstly;
- ❖ To apply ISO17025 3<sup>rd</sup> party lab certification for starting our business in providing 3<sup>rd</sup> party laboratory testing service for all sme factories and trading and buying offices, even global retailer;
- ❖ meanwhile, to promote our products in the exhibition globally;
- ❖ by parallel processes, to cooperate with international 3<sup>rd</sup> party lab and industrial association for promoting our novel screening test device;
- ❖ Even though promot our product to local governmental chemical lab, Universities, School, NGOs.

## Business Model

- ❖ Our business model based on marketing strategy to deploy a global licensing to the right manufacturer, international 3<sup>rd</sup> party laboratory and government sector firstly for selling our product globally;
- ❖ To become ISO17025 3<sup>rd</sup> party laboratory for promoting testing service and making a short term profit for keeping business operation;
- ❖ Set up oversea office for applying a new ISO test method for building up our product brand;
- ❖ meanwhile, to cooperate with international 3<sup>rd</sup> party lab and industrial association for deploying international inspection business with our novel product.



# Revenue Model – Scenario 1

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Stage	Financial Year	Cost in 1 <sup>st</sup> year (HKD)	Revenue in 1 <sup>st</sup> year (HKD)	Revenue in 2 <sup>nd</sup> year (HKD)	Revenue in 3 <sup>rd</sup> year (HKD)
1. Hardware & Software Prototype & Mass Production including mfg facilities & (16.67% in 1 <sup>st</sup> year)		(1,000,000)		Cost in 2 <sup>nd</sup> year (500,000)	Cost in 3 <sup>rd</sup> year (500,000)
2. Patent application including maintenance fee for 3 years (16.67% in 1 <sup>st</sup> year)		(1,000,000)		-	-
3. Salary of chemist and engineer (39% in 1 <sup>st</sup> year) The following positions' salary re estimated for the inflation of salary in 3 years; in fact, the salary will be lower		(2,340,000)		(2,340,000)	(2,340,000)
3.1) Chemists x 2, HKD35,000 monthly salary					
3.2) A.I. Programmer x 1, HKD30,000					
3.3) Computer Vision Programmer x 1, HKD30,000					
3.4) Senior Electronic Engineer x 1, HKD30,000					
3.5) Cloud Computing Programmer x 1, HKD30,000					
3.6) CTO x 1, who know how to do reagent, programming and electronic hardware HKD40,000					
3. Apply a new ISO test standard (only 3 years progress) (16.67% in 1 <sup>st</sup> year)		(1,000,000)		(500,000)	(500,000)
4. Management Fee e.g. premise rent, misc. expense (2% in 1 <sup>st</sup> year)		(120,000)		(120,000)	(120,000)
5. Marketing, Promotion (9% in first year)		(540,000)		(150,000)	(150,000)
6. Estimated Turnover (selling price for HKD380,000 per each set incld. 20 reagents)		0	3,800,000 [16 sets sold]	3,800,000 [10 sets sold]	3,800,000 [10 sets sold]
<b>Accum. total cost (balance brought/down + yearly cost)</b>		(6,000,000)	-	(3,610,000) + (b/d = 0) = (3,610,000)	(3,610,000) + b/d= 190,000 = (3,420,000)
<b>Revenue (Estimated turnover – Accum. total cost)</b>			6,080,000 – (6,000,000) = 80,000 (Breakeven)	3,800,000 – (3,610,000) = 190,000	3,800,000 – (3,420,000) = 380,000

# Revenue Model – Scenario 2

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Stage	Financial Year	Cost in 1 <sup>st</sup> year (HKD)	Revenue in 1 <sup>st</sup> year (HKD)	Revenue in 2 <sup>nd</sup> year (HKD)	Revenue in 3 <sup>rd</sup> year (HKD)
1. Hardware & Software Prototype & Mass Production including mfg facilities & (16.67% in 1 <sup>st</sup> year)		(1,000,000)		Cost in 2 <sup>nd</sup> year (500,000)	Cost in 3 <sup>rd</sup> year (500,000)
2. Patent application including maintenance fee for 3 years (16.67%)		(1,000,000)		-	-
3. Salary of chemist and engineer (39%) The following positions' salary re estimated for the inflation of salary in 3 years; in fact, the salary will be lower		(2,340,000)		(2,340,000)	(2,340,000)
3.1) Chemists x 2, HKD35,000 monthly salary					
3.2) A.I. Programmer x 1, HKD30,000					
3.3) Computer Vision Programmer x 1, HKD30,000					
3.4) Senior Electronic Engineer x 1, HKD30,000					
3.5) Cloud Computing Programmer x 1, HKD30,000					
3.6) CTO x 1, who know how to do reagent, programming and electronic hardware HKD40,000					
3. Apply a new ISO test standard (only 3 years progress) (16.67%)		(1,000,000)		(500,000)	(500,000)
4. Management Fee e.g. premise rent, misc. expense (2%)		(120,000)		(120,000)	(120,000)
5. Marketing, Promotion (9%)		(540,000)#		(150,000)	(150,000)
6. Estimated Turnover (selling price for HKD380,000 per each set incld. 20 reagents)		0	3,800,000 [10 sets sold]	3,800,000 [15 sets sold]	3,800,000 [15 sets sold]
<b>Accum. total cost (balance brought/down + yearly cost)</b>		(6,000,000)	-	(3,610,000) + (2,200,000) = (5,810,000)	(3,610,000) + (110,000) = (3,720,000)
<b>Revenue (Estimated turnover – Accum. total cost)</b>			3,800,000 – (6,000,000) = (2,200,000)	5,700,000 – (5,810,000) = (110,000)	5,700,000 – (3,720,000) = 1,980,000 (Breakeven)