



Firmenich

芬美意对嗅觉受体的研究和应用 - 服务社会, 创造商机

Firmenich Olfaction Receptor Biology:
Understanding the human nose and its applications on
social responsibility programs and business
opportunities in the space of malodor counteraction

01

Relevance of malodor counteractancy for consumer benefits

消费者对异味控制的认知与重视程度

02

A story of Firmenich leveraging Receptor Based Biology for latrine malodor control

芬美意在嗅觉受体生物学前沿的研究以及该技术在公厕异味控制方面的应用

03

Bill and Blinda Gates Co-Investment and Co-Innovation

与比尔和梅琳达·盖茨基金会的合作

04

Latrine odor sample collection and analysis, leading to model formation

公厕气味样品收集和分析以及异味模型的建立

05

Discovery of antagonist molecules as latrine odor counteractants using the olfactive receptor technologies

使用嗅觉受体技术寻找异味拮抗剂

06

Creation and development of solutions to latrine malodor product format and commercialization

针对公厕异味的产品及商业化解决方案

07

Potential applications in Home and Body Care categories

前景展望：嗅觉受体研究在家居及个人洗护产品中的应用

Relevance of malodor counteractancy for consumer benefits

01 消费者对异味控制的认知与重视程度

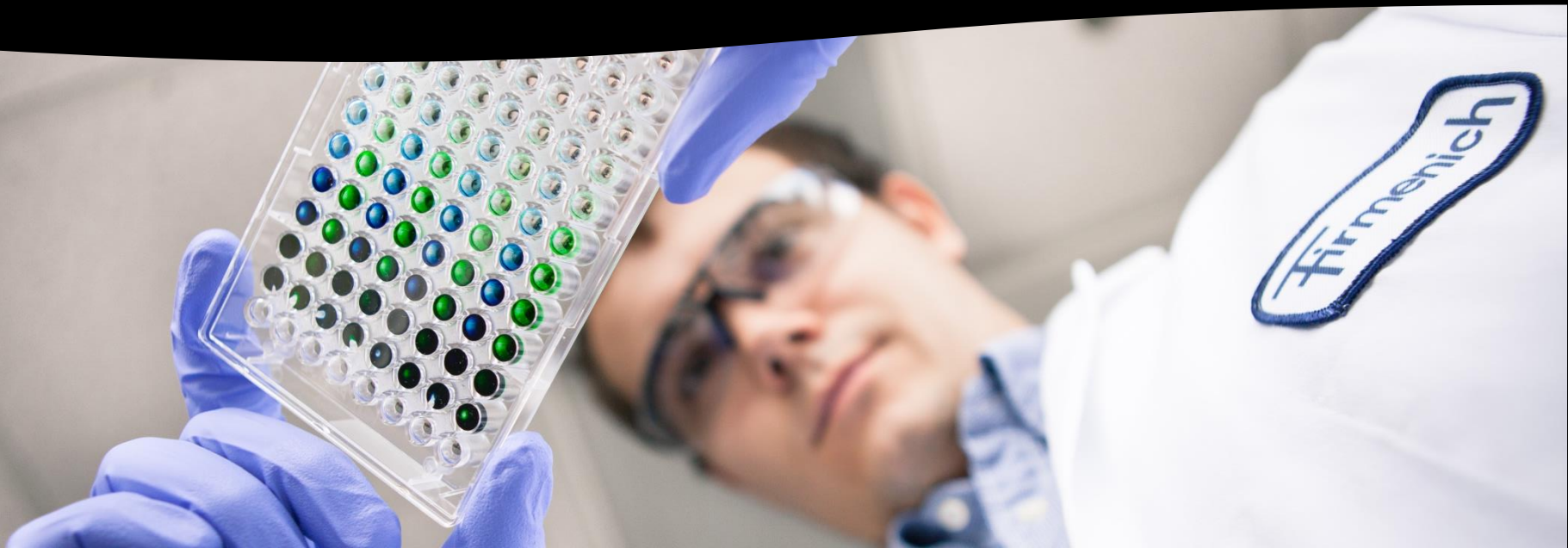


PE to add

**Relevance of Malodor counteractancy
for consumer benefits**

A story of Firmenich leveraging Receptor Based Biology for latrine malodor control

02 芬美意在嗅觉受体生物学前沿的研究以及该技术在公厕异味控制方面的应用



异味控制平台

Malodour Platform

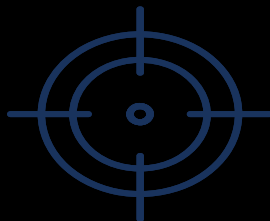
处理异味的3种策略

Three strategies for managing malodours



PREVENTION

预防



ELIMINATION

消除



SENSORY MODIFICATION

感官修饰

Anti-Microbial

抗菌

Enzyme Inhibition

酶抑制

Physico-Chemical

理化反应

Chemical Neutralization

化学中和

Receptor Blocking

阻断受体

Sensorial Integration

感官统合

嗅觉受体生物学及气味感知

Receptor Biology and Olfaction

Evaporation
挥发物



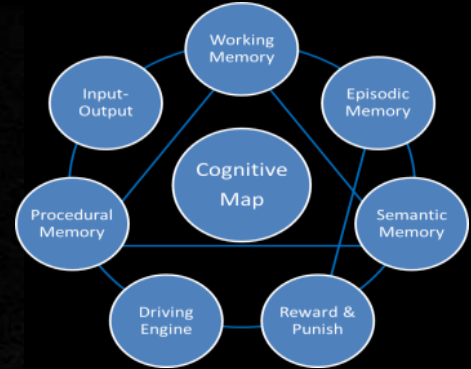
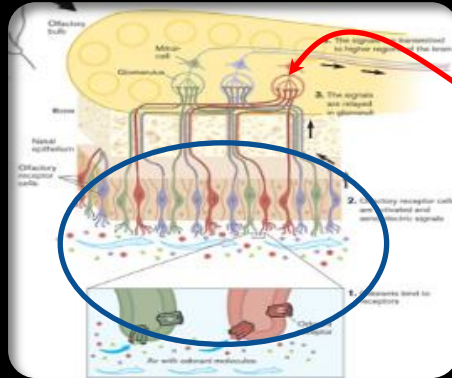
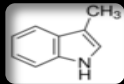
Odourant Receptors
香气受体
Olfactory Receptor Cells
嗅觉的受体细胞



Receptor Organs **受体器官**
Sensory Physiology **感官生理学**
Brain Activation **大脑激活**



Cognition **认知**
Emotion **情感**



Determination of Perceived Odour Quality and Intensity

**测定感知到的气味
品质和强度**

- Odourant receptors are the gateway to perception

嗅觉受体是感知的大门

- Downstream perception can be modified by regulating the receptor gateway

我们可以调节受体的通路来改变我们的感知

Gates Co-Investment and Co-Innovation

03 与比尔和梅琳达·盖茨基金会的合作



BILL & MELINDA
GATES foundation

Co-Funding & Sponsorship
Insights
Networks
Credibility
Passion

联合资助和赞助
目标
联络群
公信力
激情

Firmenich

探索MOC
多学科科研能力
香气体验
客户资源
公信力
激情

MOC Discovery
Multidisciplinary
Science Capabilities
Fragrance Experience
Client Access
Credibility
Passion

Make consumer use of malodor affected toilets a more desirable experience thus encouraging improved sanitation and overall quality of life

合作项目: 让消费者使用被异味影响的卫生间时能有更理想的体验
进而改善公共卫生并从整体上提升生活品质

Develop a new generation of malodor counteractant (antagonist) technologies that are effective and affordable for BOP populations

挑战: 为贫困人群开发新一代有效且经济的抗异味 (拮抗) 技术

项目设计

Project Overview

Work initiated in 2012 and consists of 2 Projects

于2012年开展工作，由2个项目组成

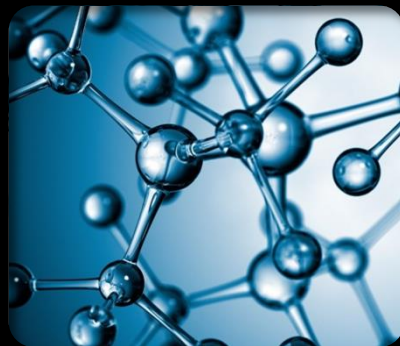
Identify and characterise BOP Latrine Malodors

识别和表征贫困人群的公共厕所异味

- 印度和非洲 India & Africa
- 结果公布于Q1 2013年
Results published Q1 2013



Project 1
项目1



Project 2
项目2

Develop MOC solutions for BOP Latrines

为贫困人群的公共厕所开发 MOC 解决方案

- 3 年
- 3 阶段
- 联合资助

Latrine odor sample collection and analysis, leading to model formation

04 公厕气味样品收集和分析以及异味模型的建立



样品采集 Sampling

Project 1
项目1

Field Trips to identify components of malodors (sludge & headspace) 5 locations across 4 countries
Evaluation of urine and faeces odors

实地考察以识别异味的成份 (污水& 顶端空间) 4个国家的5个地点
评估尿液和粪便的气味



Durban, South Africa

Nairobi, Kenya

Kampala, Uganda

Pune, India

Ahmedabad, India

德班, 南非

内罗毕, 肯尼亚

坎帕拉, 乌干达

浦那, 印度

艾哈迈达巴德, 印度



方法建立 Method Development

11 latrines of 2 distinctive designs

Ventilated pit Urine diversion

On-site perfumer evaluation

3 complementary VOC sampling techniques

- On-site **headspace analysis**
- Forced **SPME** headspace of sludge samples
- On-site **solid phase extraction** of sludge samples

2种设计的11间厕所:

通风井尿液分流

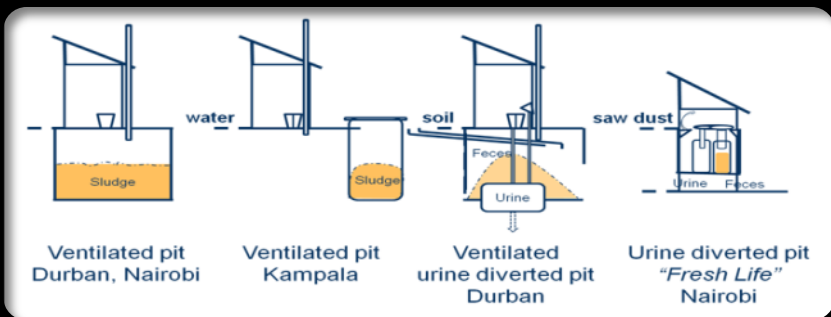
调香师现场评估

3种补充的VOC采样技术:

现场顶空分析

对泥状样品的强制固相微萃取顶空分析

污水样品现场固相萃取

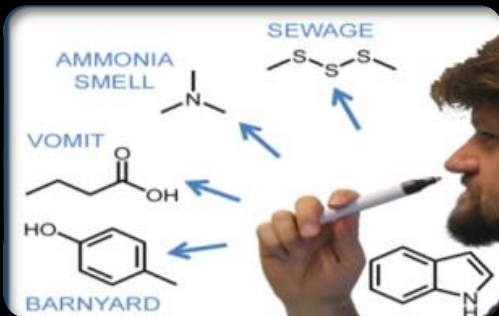


异味模型构建与验证

Malodor Model Construction And Validation

Simplified reconstitutions of various malodors representing real-life situations
 Validation by local populations (~130 subjects by country) of offending malodor reconstitutions
 Publication of sensory field validation results

简单重构表现真实生活的各种味道 由当地人群检验(各个国家的130名被试者) 异味重构 发表感官现场检验成果



Research article
 Published online in Wiley Online Library
 DOI: 10.1002/ffm.3292

Sensory survey of key compounds of toilet malodour in Switzerland, India and Africa

Charles Jean-François Chappuis,* Yvan Niclass, Isabelle Cayeux and Christian Starckenmann

Abstract: Improving sanitation in developing countries is a key issue. New toilets must be clean and well maintained and must present a pleasant olfactory experience. Knowledge about toilet malodour is crucial to create pleasant perfumes for toilets. To identify the key constituents of toilet malodour, we created synthetic reconstitutions based on our previous analytical work, and we performed sensory surveys in Switzerland, India and Africa to evaluate the efficiency of our synthetic reconstitutions made of selected key compounds to evoke toilet malodour. The olfactory stimuli were two reconstitutions of faecal odours and a reconstitution of stale urine odour. We also used three perfumes as controls: banana, lemon and lavender. Participants from Geneva (N = 21, Switzerland) and from the slums of Ahmedabad (N = 109, India), Nairobi (N = 143, Kenya) and Durban (N = 146, South Africa) were familiar with all odours presented. They described banana, lemon and lavender as pleasant odours and both faecal reconstitutions and stale urine reconstitution as unpleasant odours. Faecal reconstitutions were identified as odours that emanate from faeces or latrines in all countries. These results confirm and consolidate those of previous studies on faecal odours in identifying butyric acid, p-cresol, indole and dimethyl trisulfide as strong contributors to human faecal odour. © 2015 The Authors. *Flavour and Fragrance Journal* published by John Wiley & Sons, Ltd.

Additional supporting information may be found in the online version of this article at the publisher's web site

Discovery of antagonist molecules as latrine odor counteractants using the olfactive receptor technologies

05 使用嗅觉受体技术寻找异味拮抗剂

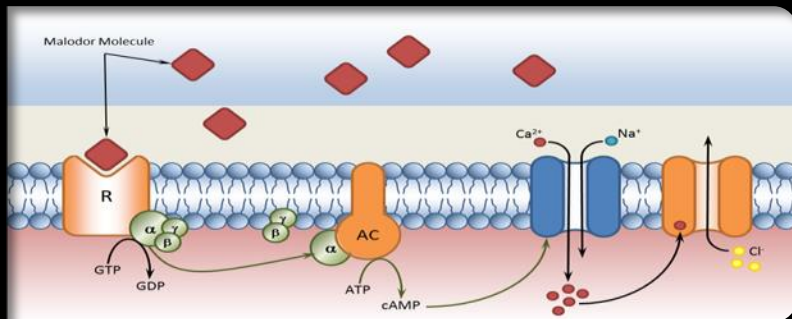


受体阻断机制

Receptor Blocking Mechanism

Malodour Molecule Mode of Action

异味分子的作用方式



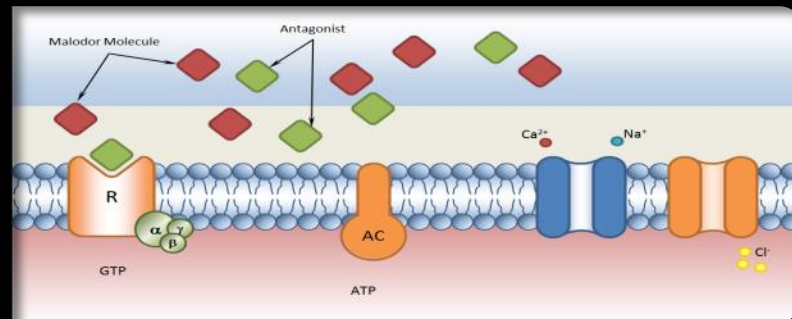
Binding of the malodour molecule to the receptor initiates a complex cascade of biochemical reactions that ultimately leads to a massive flux of Ca²⁺ and other ions in and out of the cell.

异味分子与受体结合，会引发一系列复杂的生化反应，最终导致大量的Ca²⁺和其他离子在细胞中进出。

Malodour Perception 感知到异味

Antagonist Molecule Mode of Action

拮抗分子的作用方式



The antagonist occupies the same site at the receptor but does not initiate the biochemical cascade. No signal is sent to the brain.

拮抗剂在受体处占据相同的位置，但不引发一系列生化反应。没有信号传递到大脑。

No Malodour Perception 感知不到异味

Antagonist Discovery Platform 拮抗剂探索平台

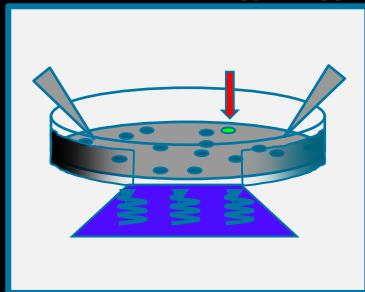
3-Pillar Technology Platform 三大支柱技术平台

I. Sensory 感官
(Jar, Dynascent®)



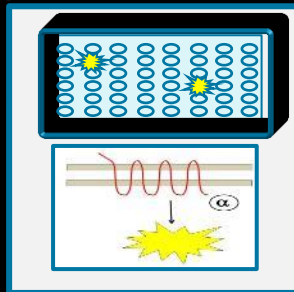
Confirmation 评定

II. Live Neuron 活体神经元
(cultured neurons 培养的神经元)



**High-Throughput 高通量
Receptor Screen 受体筛选**

III. Cell Lines 细胞株
(cultured cells 培养的细胞)



**High-Throughput 高通量
Odorant Screen 气味筛选**

Enablers 支持平台

Compound Management 化合物分类

- 800 value cmpds.
- Target collections

Synthesis 合成

- New compounds 新化合物

Knowledge Sci. 知识管理

- Data management 数据管理
- Data analysis tools 数据分析工具

Discovery of Antagonists and Their Efficacy

拮抗剂的发现和拮抗效果的测定

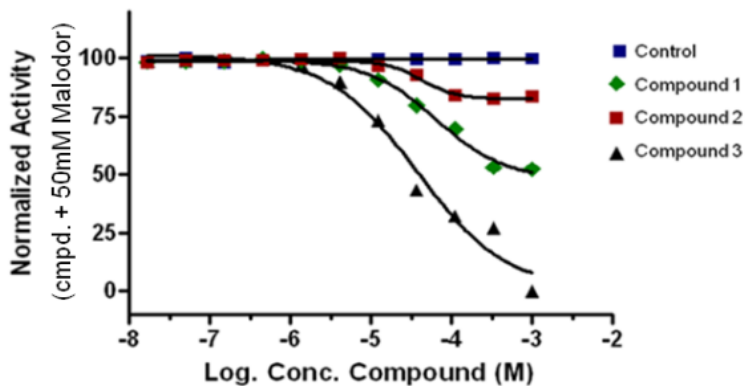
Understanding effective dosage of antagonists required to reduce malodor to minimum perception

了解拮抗剂的有效剂量，以减少异味至最低感知限度

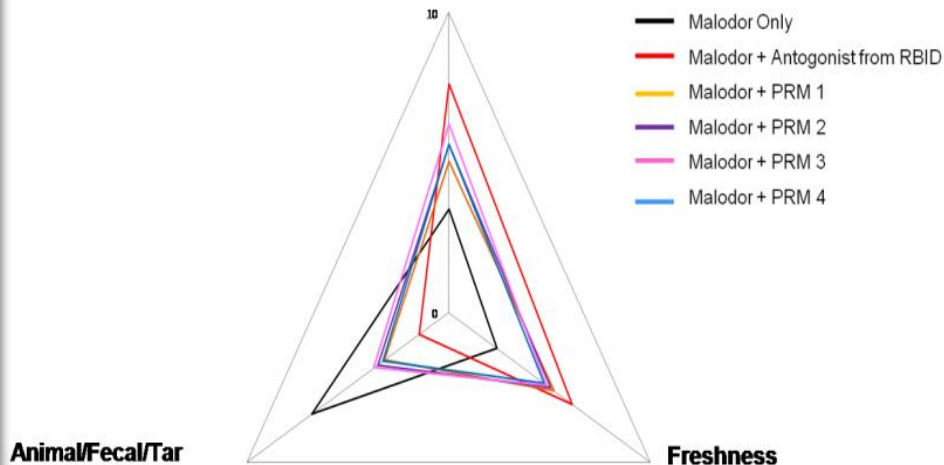
Demonstrating ability to reduce perceived attributes that contribute to malodour

表现出降低感知气味的能力

Malodor Antagonist Results (OR 1)

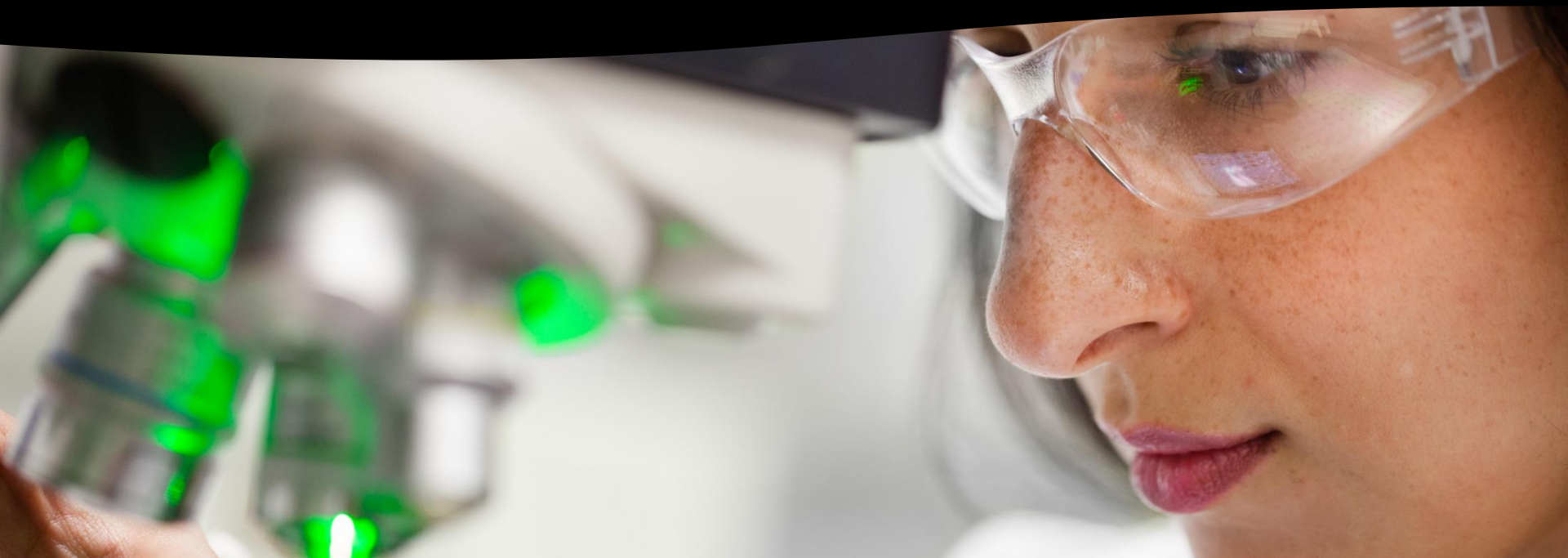


Pleasantness



Creation and development of solutions to latrine malodor product format and commercialization

06 针对公厕异味的产品及商业化解决方案





花香



橙香



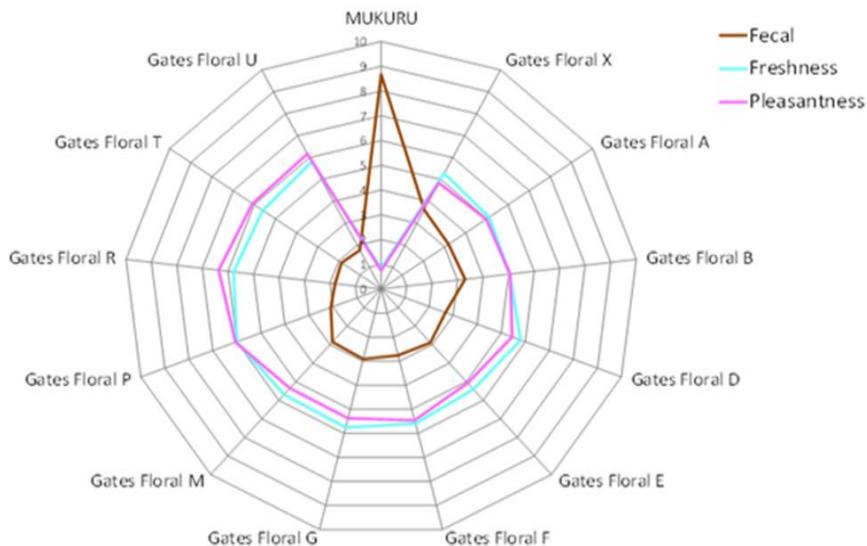
茉莉花香

Three Fragrances for Malodor Control

3款异味控制香精

感官结果

Sensory Results



使用拮抗剂可以改善所有的香气

Use of antagonists yields **improvement in all fragrance tonalities**

Latest versions of GATES FLORAL incorporate 50 - 70% by weight antagonists

基本的产品形式

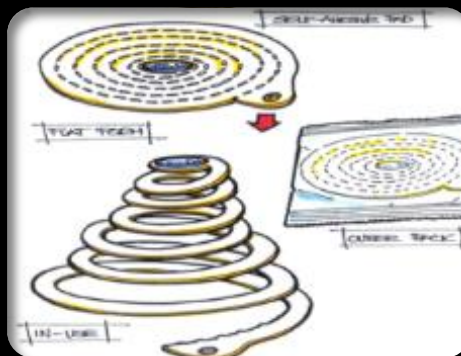
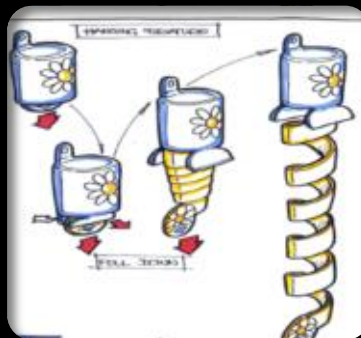
Potential Product Formats

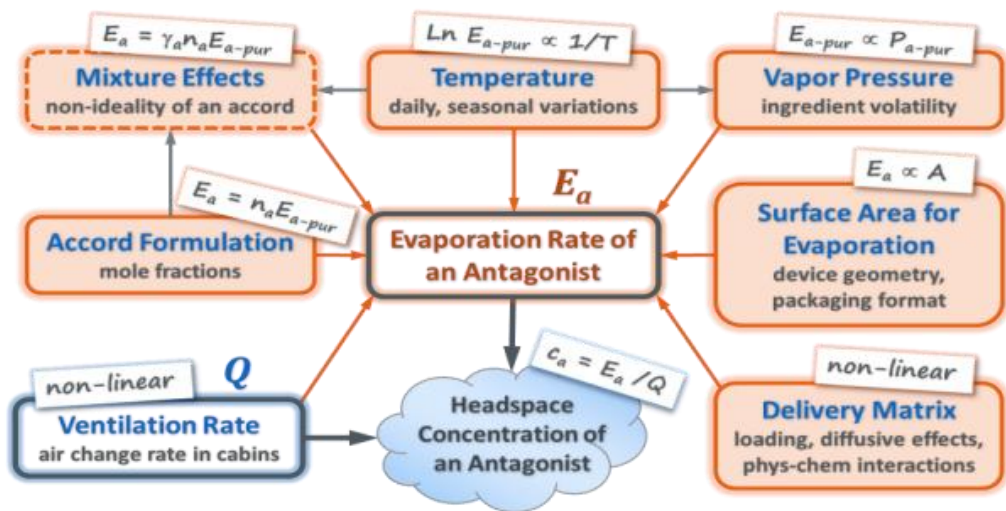
Most suitable formats for performance: **Air Freshener or Surface Care Product**

最能体现效果的合适的产品型式: 空气清新剂 或者表面护理剂

1. Air Freshener: **Porous cellulose substrate** with fragrance absorbed onto it or pump spray 空气清新剂: 吸附有香精的多孔纤维素基底或泵式喷雾器
2. Surface Care: **Cleaning powder** e.g. could be stabilised bleach powder with starch 表面清洁剂: 清洁粉剂 如含淀粉包埋微胶囊香精的漂白粉 **encapsulated fragrance** (to protect fragrance/antagonists from base) **被包裹的香精** (从基础上保护香精/拮抗剂)

Field testing carried out with prototypes
成型产品已做实地试验





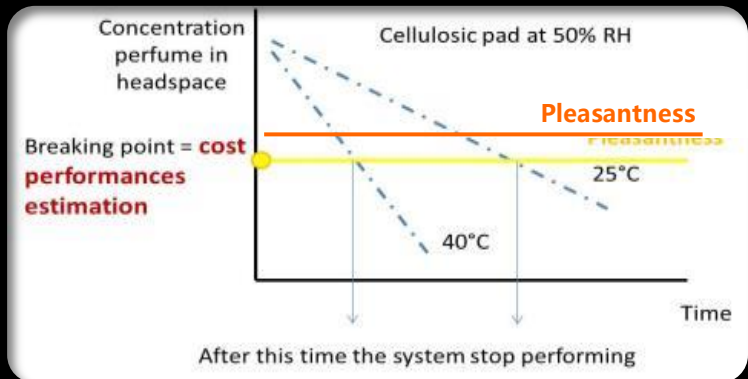
产品雏形开发 Prototyping

Antagonist delivery: Evaporation Rate

- 湿度对蒸发的影响
Effect of Humidity on Evaporation
- 载体材料的筛选
Screening of carrier materials
- 香原料的蒸发速率
Evaporation rates of ingredients
- 稳定性 Stability

Model Cabines: Characterisation of Cost-Performance

模型小屋: 成本-性能测试



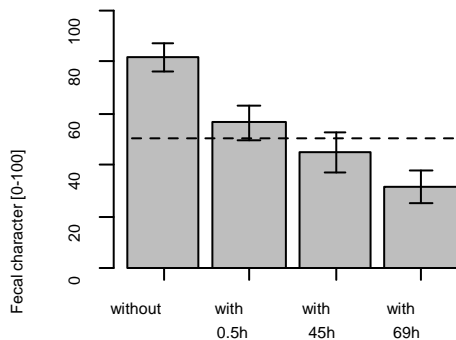
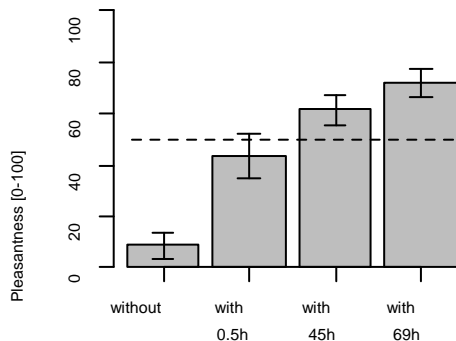
验证 Validation

在控制的实验条件下
在现场

Under controlled conditions

In the field

结果 Results



带排风的蹲坑厕所
 香精: 盖茨 花香5号
 Ventilated pit-latrine
 Perfume: Gates Floral V

印度温和型漂白粉

Mild Bleach Powder in India

The Power of Bleach 漂白粉

bleach powder is common ==> **cultural habit**

漂白粉是日常用的 ==> 使用习惯

treats germs + malodor ==> **functional benefit**

对付细菌+ 去除异味==> 功效

India-made “Stable Bleaching Powder” (SBP) as base for scented cleaning powder

印度的 “稳定型漂白粉” 作为基体来制作加香的去污粉

Based on $Ca(OCl)_2$ but different process 基于次氯酸钙，但是使用不同的工艺

Lower (30-36%) Chlorine content than $Ca(OCl)_2$ 比次氯酸钙低的含氯量 (30-36%)

Antagonists within starch encapsulation 拮抗剂用于淀粉微胶囊中



$Ca(OCl)_2$ ($\geq 65\%$ Cl): starch encaps oxidize
次氯酸钙 ($\geq 65\%$ Cl): 淀粉微胶囊被氧化

Indian SBP (32% Cl): starch encaps survive
印度稳定型漂白粉 (32% Cl): 淀粉微胶囊可以耐受

产品形式的优缺点

Product Format: Pros and Cons



Aerosol 喷雾剂

- Delivery – Best delivery of technology, Fast reaction to issue
释放 – 最佳的释放技术, 快速解决问题
- Stability – Very stable, low effect on perfume/technology
稳定性 – 非常稳定, 对香精/释放技术影响甚微
- Cost – High
成本 – 高

Mild Bleach Powder 温和型漂白粉

- Delivery – Low concentration, encapsulated fragrance
释放 – 低浓度, 微胶囊香精
- Stability – Poor stability, requires encapsulation
稳定型 – 稳定性差, 需要微胶囊香精
- Cost – V. Low for powder, encaps add cost
成本 – 对粉剂而言很低, 微胶囊增加成本



Cellulose Pad 纤维素板

- Delivery – Good delivery of technology but less effective over time
释放 – 好的释放技术, 但是放置时间越长效果变得越弱
- Stability – Stable
稳定性 – 稳定
- Cost – Medium
成本 – 中

Liquid Cleaner 液体清洁剂

- Delivery – Good, relatively high fragrance content
释放 – 好, 相对较高的香精浓度
- Stability – Stable, depending on formulation
稳定性 – 稳定高 (取决于配方)
- Cost – High
成本 – 高



Non Bleach Detergent/Toilet Powder 不含漂白粉的洗涤剂/马桶去污粉

- Delivery – good delivery, high concentration
释放 – 好的释放技术, 高浓度
- Stability – neutral base, good stability
稳定性 – 中性基质, 稳定性好
- Cost – Low
成本 – 低

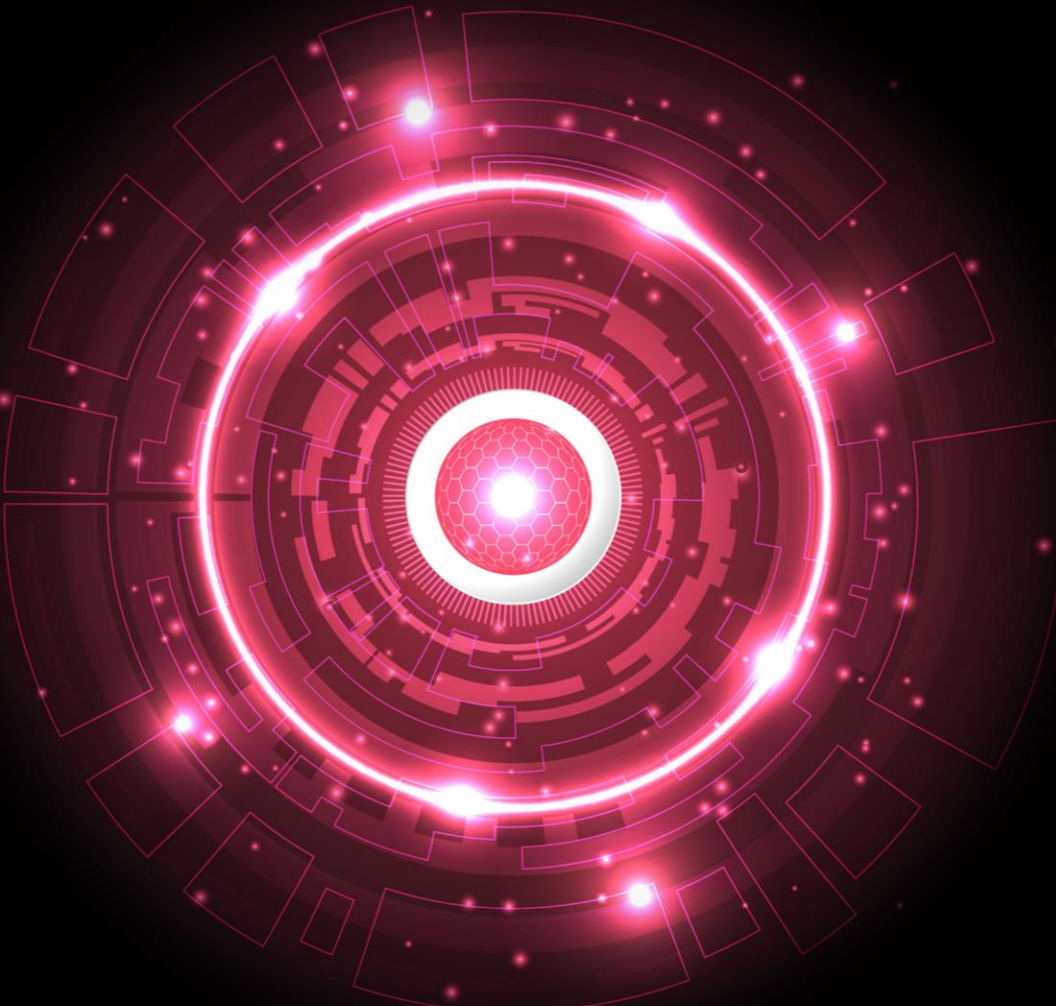
Potential applications in Home and Body Care categories

07 前景展望：嗅觉受体研究在家居及个人洗护产品中的应用



PE to add

Potential applications in Home and Body Care categories



Thank You
谢谢

Visit us at Booth xx