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BIOS

学术兼职 Academic Position

- ✓ 中国城市环境卫生协会餐厨垃圾专业委员会主任委员
Chairman Member of the Food Waste Professional Committee of China Urban Environmental Sanitation Association
- ✓ 住建部环卫标准专家技术委员会委员
Member of the Environmental Sanitation Standards Expert Technical Committee of the Ministry of Housing and Urban-Rural Development
- ✓ 住建部科学技术委员会环境卫生专业委员会委员
Committee of Environmental Sanitation Professional Committee, Science and Technology Committee of Ministry of Housing and Urban-Rural Development
- ✓ 中国国际咨询工程公司资源与环境领域第二届专家技术委员会委员
Member of the 2nd Expert Technical Committee in the Field of Resources and Environment of China International Consulting Engineering Corporation
- ✓ 中国环境科学学会固废分会专家委员
Expert Committee Member of the Solid Waste Branch of the Chinese Society of Environmental Sciences
- ✓ 北京市土壤修复评审委员会委员
Member of Beijing Soil Remediation Review Committee
- ✓ 北京市市容环境卫生协会顾问
Consultant of Beijing City Appearance and Environmental Sanitation Association



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主要研究领域 Main research areas

长期从事有机固体废物资源化处理技术和政策研究，参与国内多项餐厨垃圾、厨余垃圾和地沟油的处理处置工程，现场经验丰富。

He has long been engaged in the research of organic solid waste resource treatment technology and policy, participated in a number of domestic kitchen waste, kitchen waste and waste oil treatment and disposal projects, and has rich on-site experience.

主要学术成果 Major academic Achievements

主持国家自然科学基金、科技支撑等国家、省部级项目20余项，主持编写国家标准2项，出编学术著作7部，发表论文80余篇。

He has presided over more than 20 national, provincial and ministerial projects, such as National Natural Science Fund and science and Technology Support, presided over the compilation of 2 national standards, published 7 academic works, and published more than 80 papers.

ADB TA-9611 PRC

基于垃圾分类的厨余垃圾资源化处理技术路线分析

Analysis on the technical route of kitchen waste recycling disposal based on waste separation

任连海 Lianhai REN

2022年8月25日 25 August 2022

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Analysis on the technical route of kitchen Waste disposal in China

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1.我国厨余垃圾产生现状分析 ANALYSIS ON THE CURRENT SITUATION OF KITCHEN WASTE IN CHINA

➤ 我国垃圾分类背景 Background of waste separation in China

- 2016年12月21日，习近平总书记主持召开中央财经领导小组第十四次会议时指出：**普遍推行垃圾分类制度**，关系13亿多人生活环境改善，关系垃圾能不能减量化、资源化、无害化处理。要加快**建立分类投放、分类收集、分类运输、分类处理的垃圾处理系统**，形成以法治为基础、政府推动、全民参与、城乡统筹、因地制宜的垃圾分类制度，努力提高垃圾分类制度覆盖范围。
- On December 21, 2016, Chairman Xi presided over the 14th meeting of the Central Finance and Economics Leading Group and pointed out: **The widespread implementation of a waste separation system** will affect the improvement of the living environment of more than 1.3 billion people, and whether the waste can be reduced, recycled, and safe disposed. It is necessary to speed up the establishment of a **waste disposal system of separated disposal, separated collection, separated transportation, and separated disposal**, and form a waste separation system based on the rule of law, government promotion, public participation, urban and rural coordination, and local conditions, and strive to improve the coverage of the waste separation system.

1.我国厨余垃圾产生现状分析 ANALYSIS ON THE CURRENT SITUATION OF KITCHEN WASTE IN CHINA

➤ 我国垃圾分类背景 Background of waste separation in China

- 2016年,国家发改委、住建部联合发文,明确到2020年底,重点城市生活垃圾得到有效分类,实施生活垃圾强制分类的重点城市,生活垃圾分类收集覆盖率达到90%以上,生活垃圾回收利用率达到35%以上。
- In 2016, the NDRC and the MOHURD jointly issued a document stating that by the end of 2020, MSW in key cities will be effectively separated, and the coverage rate of MSW separated collection in key cities will reach over 90%, and the MSW recycling rate will reach over 35%.
- 加强科学管理、形成长效机制、推动习惯养成。
- Strengthen scientific management, form a long-term mechanism, and promote habit formation.

1.我国厨余垃圾产生现状分析 ANALYSIS ON THE CURRENT SITUATION OF KITCHEN WASTE IN CHINA

➤ 产生量 AMOUNT

全国城镇人口8.21亿，人均产生生活垃圾按1kg/d计，全国每年产生生活垃圾约3亿吨；

The urban population in China is 821 million, and the per capita amount of MSW generated is 1kg/d, which generates about 300 million tons of MSW every year.

垃圾分类后，分出厨余垃圾约为生活垃圾的20%-30%，按30%计，全国每年产生厨余垃圾约9000万吨，和每天约25万吨，实际清运量约20万吨/日。

After the implementation of waste separation, the kitchen waste is about 20%-30% of the MSW. Calculated as 30% , about 90 million tons of kitchen waste are generated every year , about 250,000 tons per day, and the actual removal amount is about 200,000 tons/day.

逐年呈上升趋势：城镇化、农业现代化、旅游等；+菜市场生鲜垃圾

An upward trend year by year: urbanization, agricultural modernization, tourism, etc.; + fresh waste from vegetable markets

➤ 成分-与餐厨垃圾类似 COMPOSITION-SIMILAR TO FOOD WASTE

组成：剩饭菜、果皮、蔬菜残余、骨头、包装物..... **Composition:** leftovers, peels, vegetable residues, bones, packaging materials, etc.

组分：水、淀粉、蛋白、脂肪（1%）、纤维素..... **Ingredients:** water, starch, protein, fat (1%), cellulose, etc.

组成元素：C、H、O、N、S、Cl、Ca、Na..... **Composition elements:** C, H, O, N, S, Cl, Ca, Na, etc.

2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 源头分类环节 Source separation

• 居民分类 (参与率、准确率)

Separation by residents (participation rate, accuracy rate)

- 菜帮菜叶、瓜果皮核、剩饭剩菜、废弃食品、蛋壳、茶渣、骨头内脏、残枝落叶等
- Vegetable leaves, peels and cores of fruits, leftovers, egg shells, tea residues, etc.

• 投放环节 Delivery

- 是否破袋? 人工、机械? bag broken or not? manual or mechanical?
- 垃圾容器; Waste container
- 就地处理 (中转站) : On-site disposal (transfer station) :
- 压缩、脱水、干燥; Compression, dehydration and drying
- 肥料化 Fertilization



2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 我国厨余垃圾资源化处理技术分析（一）

Analysis on recycling disposal technology of kitchen waste in China (1)

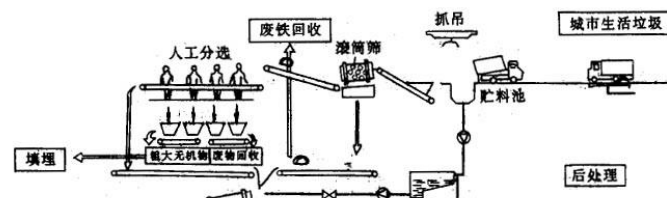
• 好氧堆肥技术 Aerobic composting technology

• 问题 Questions

- 是否腐熟 Whether it is rotten
- 恶臭气体 Malodorous gas
- 场地的问题 Site problem
- 产品销路问题 Product sales problem

• 部分问题解决对策 Solutions to some

- 掺入辅料或协同发酵 Blending with auxiliary materials or syn
- 臭气控制（舱式发酵） Odor control （Cabin fermentation）



条垛式堆肥 Stack composting

2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 我国厨余垃圾资源化处理技术分析（二）

➤ Analysis on recycling disposal technology of kitchen waste in China (2)

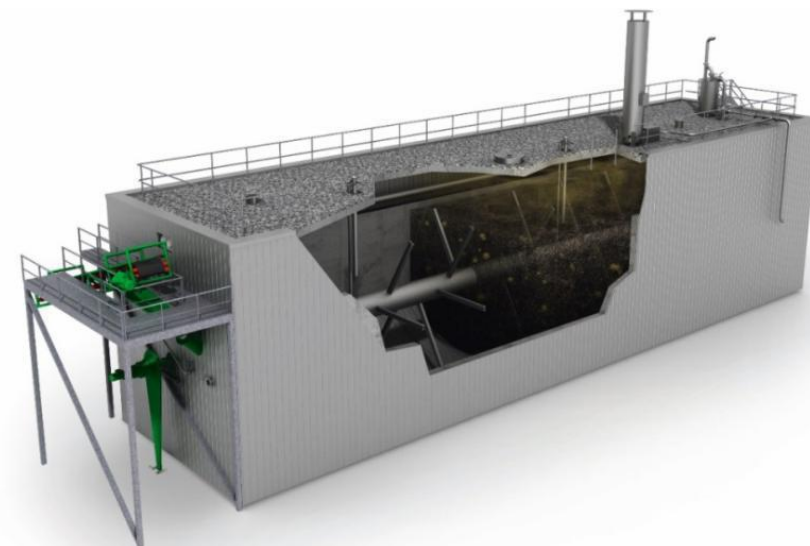
干式厌氧发酵技术 Dry anaerobic fermentation technology

- **垃圾协同厌氧：与污泥、粪便、生鲜垃圾、园林废物等协同**
Waste synergistic anaerobic: with sludge, excrement, fresh garbage, garden waste
- **搅拌方式：气力、机械** Stirring method: manpower, machinery
- **进出料难** Difficult feeding and discharging
- **菜市场生鲜垃圾** Fresh waste in vegetable market
- **沼渣处置** Disposal of biogas residue
- **除臭** Deodorization
- **沼气净化** Biogas purification



湿式厌氧发酵技术 Wet anaerobic fermentation technology

- **沼液处理的问题** Problems of biogas slurry treatment
 - **氨氮的去除** Removal of ammonia nitrogen
 - **浓液的处置** Disposal of concentrated waste liquid



2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 我国厨余垃圾资源化处理技术分析（三）

➤ Analysis on recycling disposal technology of kitchen waste in China (3)



特点: Characteristics

- 简单可行 Simple and feasible
- 利用率高 High utilization
- 与焚烧设施协同处理 Coordinated disposal with incineration facilities
- 对焚烧工况有影响 Affect the incineration conditions



2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 我国厨余垃圾资源化处理技术分析（四）

➤ Analysis on recycling disposal technology of kitchen waste in China (4)

饲喂小动物： Feeding animals

- 黑水虻 Black water fly
- 蝇蛆 Fly maggot
- 美国蜚蠊 American cockroach
- 金粉虫 Mealworm

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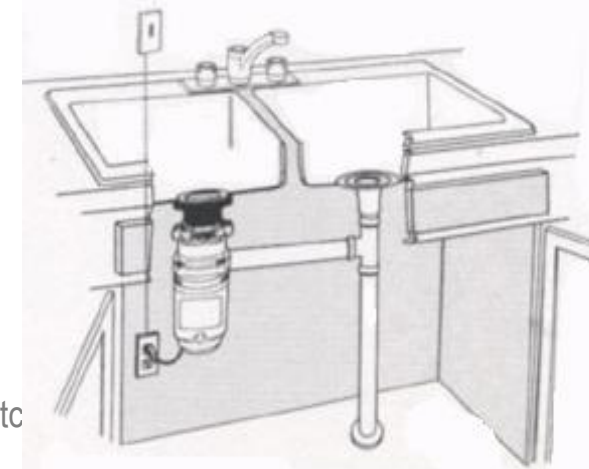
2.我国厨余垃圾处理技术路线分析 ANALYSIS ON THE TECHNICAL ROUTE OF KITCHEN WASTE DISPOSAL IN CHINA

➤ 我国厨余垃圾资源化处理技术分析（五）

➤ Analysis on recycling disposal technology of kitchen waste in China (5)

就地处理 On-site disposal

- **物理破碎** Physically crushing
 - 市政管道堵塞、浪费水、污水处理负荷等问题。
Problems such as blockage of municipal pipelines, waste of water and sewage treatment, etc
- **生物处理** Biological disposal
 - 能耗、辅料、剩余物的处置等问题。 Disposal of energy consumption, etc
- **热解气化** Pyrolysis gasification
 - 气体污染控制 Gas pollution control
 - 剩余焦油废渣处置 Tar waste residue disposal
- **优势和问题** Advantages and problems
 - 土地、环评、可研等手续简化 Simplified procedures for land, environmental impact
 - 简单可靠、清洁卫生 Simple, reliable and clean
 - 单位处理成本高 High cost
 - 日常维护难 Daily maintenance is difficult



3.结束语 CONCLUDING REMARKS

1、我国厨余垃圾处理技术已有若干工程尝试，但仍处于起步阶段，政策、标准规范、技术和模式尚需不断完善；

Kitchen waste disposal technology has been tried in several projects in China, but it is still at the **preliminary stage**, and policies, standards, technologies and models need to be continuously improved ;

2、好氧堆肥、厌氧发酵、协同焚烧、物理破碎、生物处理机、热解气化等技术各有特点，皆面临一些问题亟待解决；

Disposal technologies such as aerobic composting, anaerobic fermentation, coordinated incineration, physical crushing, biological disposal, pyrolysis gasification, etc. have their own characteristics, and they all face some problems that need to be solved urgently.

3、前端分类投放、分类收集、分类运输的效果对厨余垃圾处理设施具有重要影响。

The effects of **front-end separated placing**, separated collection, and separated transportation have an important impact on kitchen waste disposal facilities.

THANKS!

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