Biogas From Organic Waste From Cities

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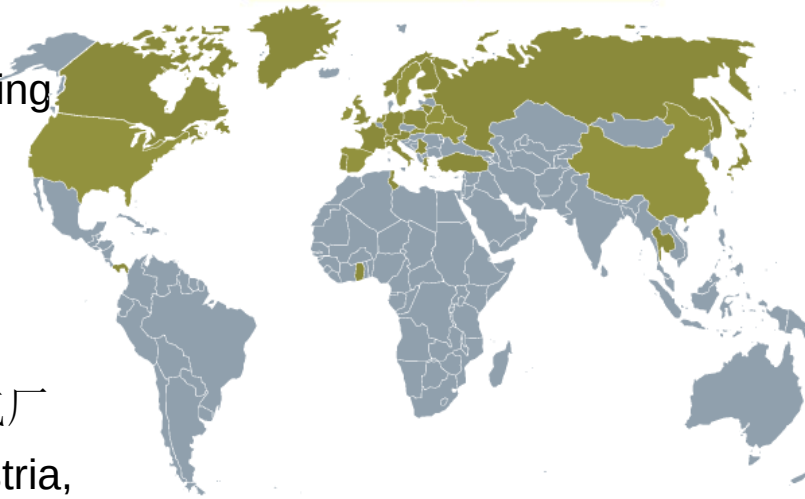
K&F工程有限公司



Engineering Office, specialized in Design and Engineering of Biogas Plants 专门从事沼气领域内的设计和工程

Foundation成立于: 1999

Team 共有员工: 29

Experience 经验: > 25 Years

References曾设计: ca. 150 Biogas Plants 150多个沼气厂

In 主要在: Germany, Japan, Netherlands, Austria, Switzerland, Lithuania, Italy, Slovakia, Canada, USA, Spain, France, Ireland and Russia
德国， 日本，荷兰， 澳大利亚，瑞士，立陶宛， 意大利，斯洛伐克，加拿大，美国，西班牙，法国和爱尔兰

Service offerings of Krieg & Fischer in the field of Biogas
沼气领域内K&F提供的服务

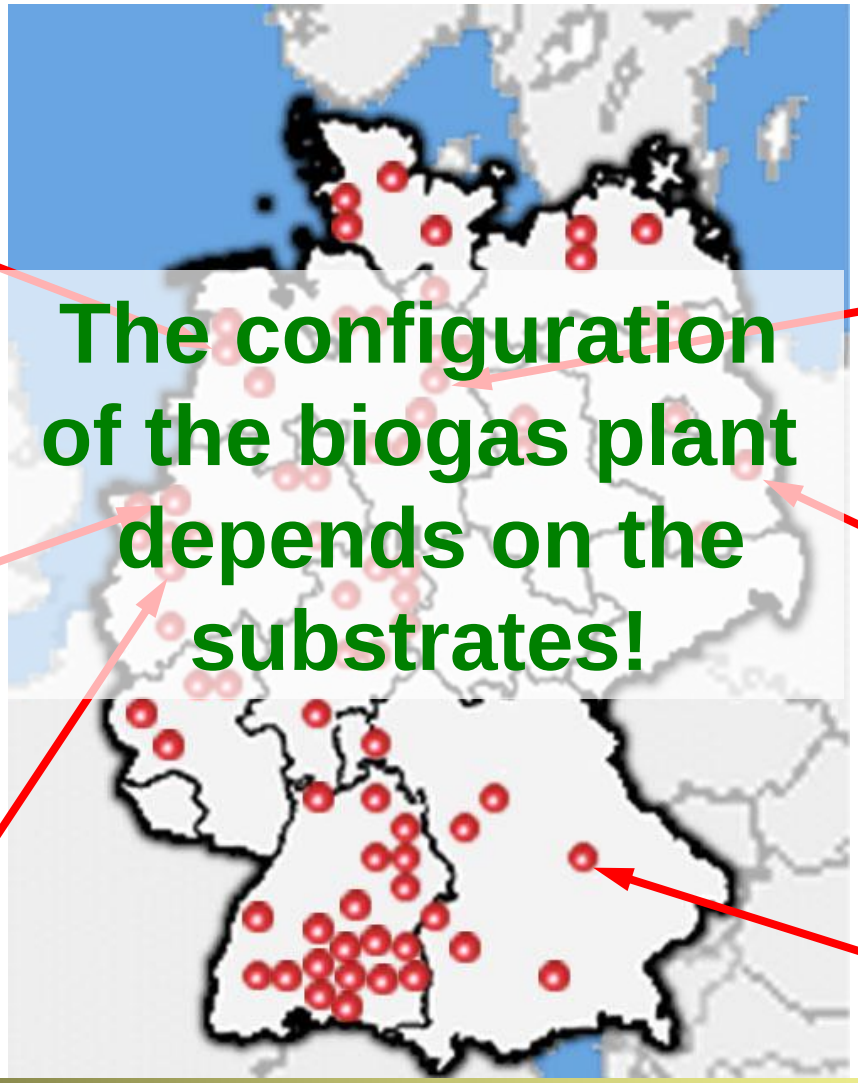
- Studies 调研
- Concept Development 创新发展
- Calculations 核算
- Permits & Approvals 许可和审批
- Engineering 工程
- Tendering and Commissioning 投标和试运行
- Supervision of Construction 建设施工
- Start-up 启动
- Optimization/Retrofits 优化设计
- Supervision and Consulting 监理和咨询

References – Examples
全球项目

Central Biogas Plant

Energy Crop Biogas Plant

Kitchen Waste Digestion



The configuration of the biogas plant depends on the substrates!

Potato Residue Digestion

Energy Crops with Cattle Manure

Biowaste Digestion

Demo-Projects
and first order K&F in China

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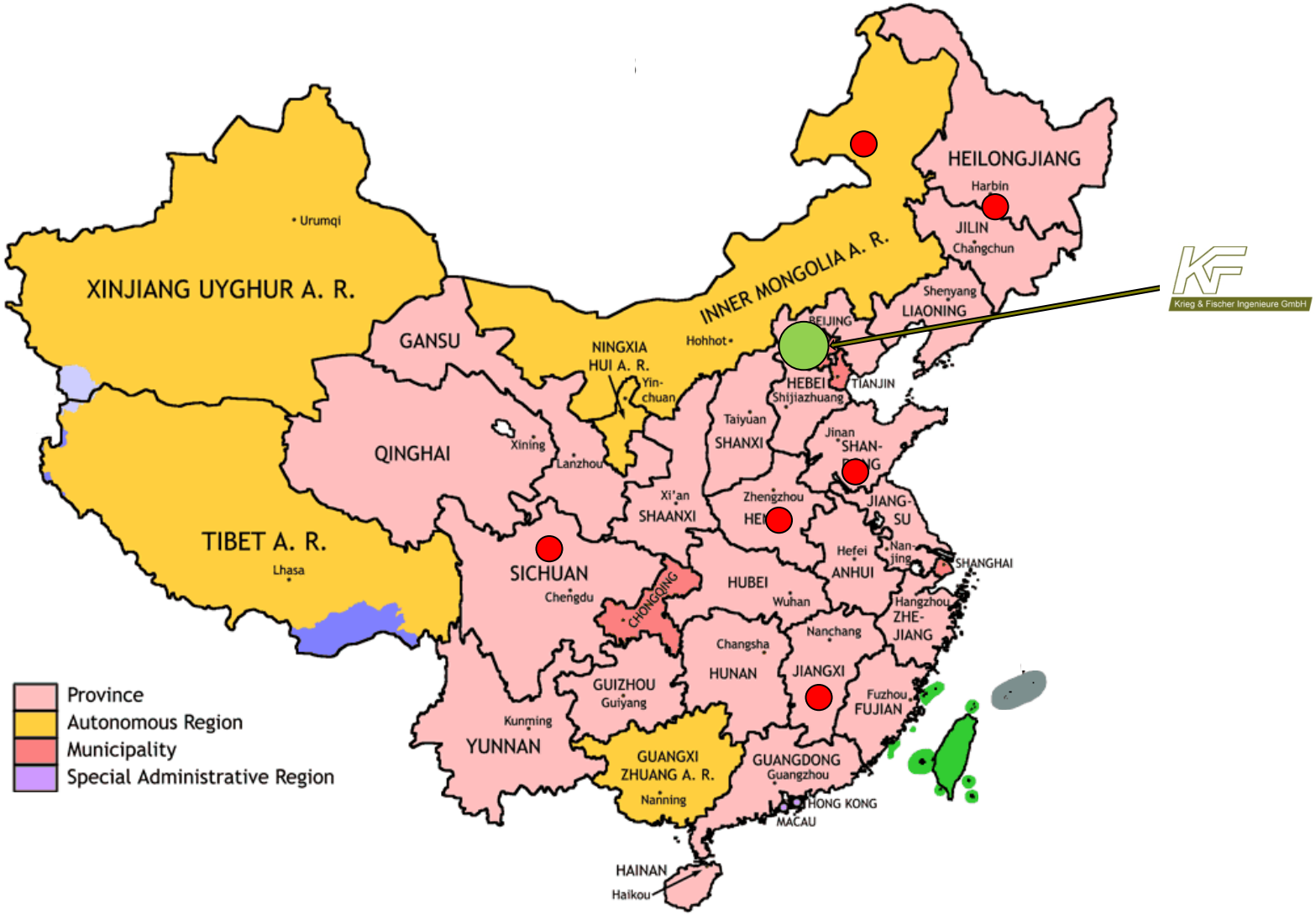

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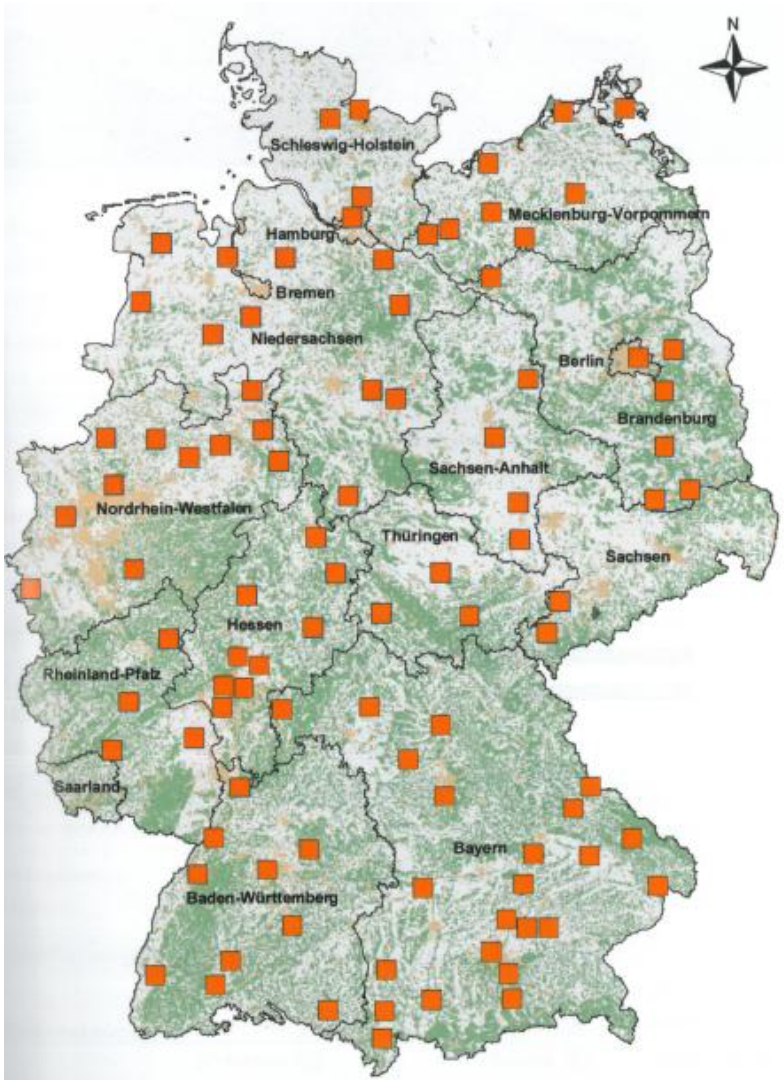
Collection of BMW in Germany

Separation of waste in households

- paper
- plastic and metals,
- organic waste,
- residual waste

Organic waste consist of kitchen waste and garden waste

Biogas production from BMW in Germany 2011



BMW
Biological **M**unicipal
Waste=
Source separated
household waste

Wet digestion	Plug flow digester	Fermentation garage type
44	22	14
55%	28%	17%

Source: Biogas-Atlas 2011/12; Anlagenhandbuch der Vergärung biogener Abfälle in Deutschland; Witzenhausen-Institut für Abfall, Umwelt und Energie GmbH; 2011; Bioabfallvergärungsanlagen in Deutschland 2011

Biodegradable municipal waste (BMW) in Germany

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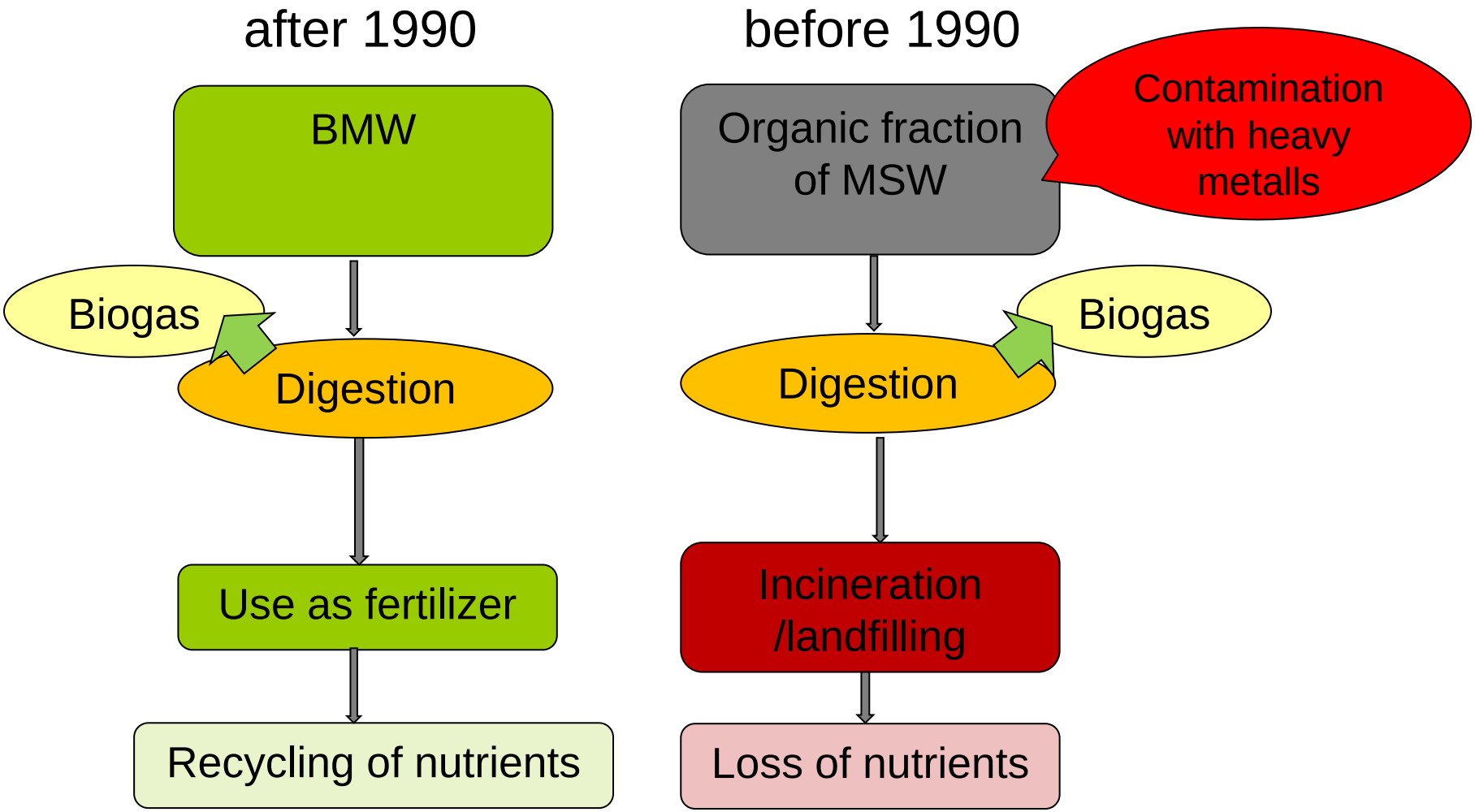
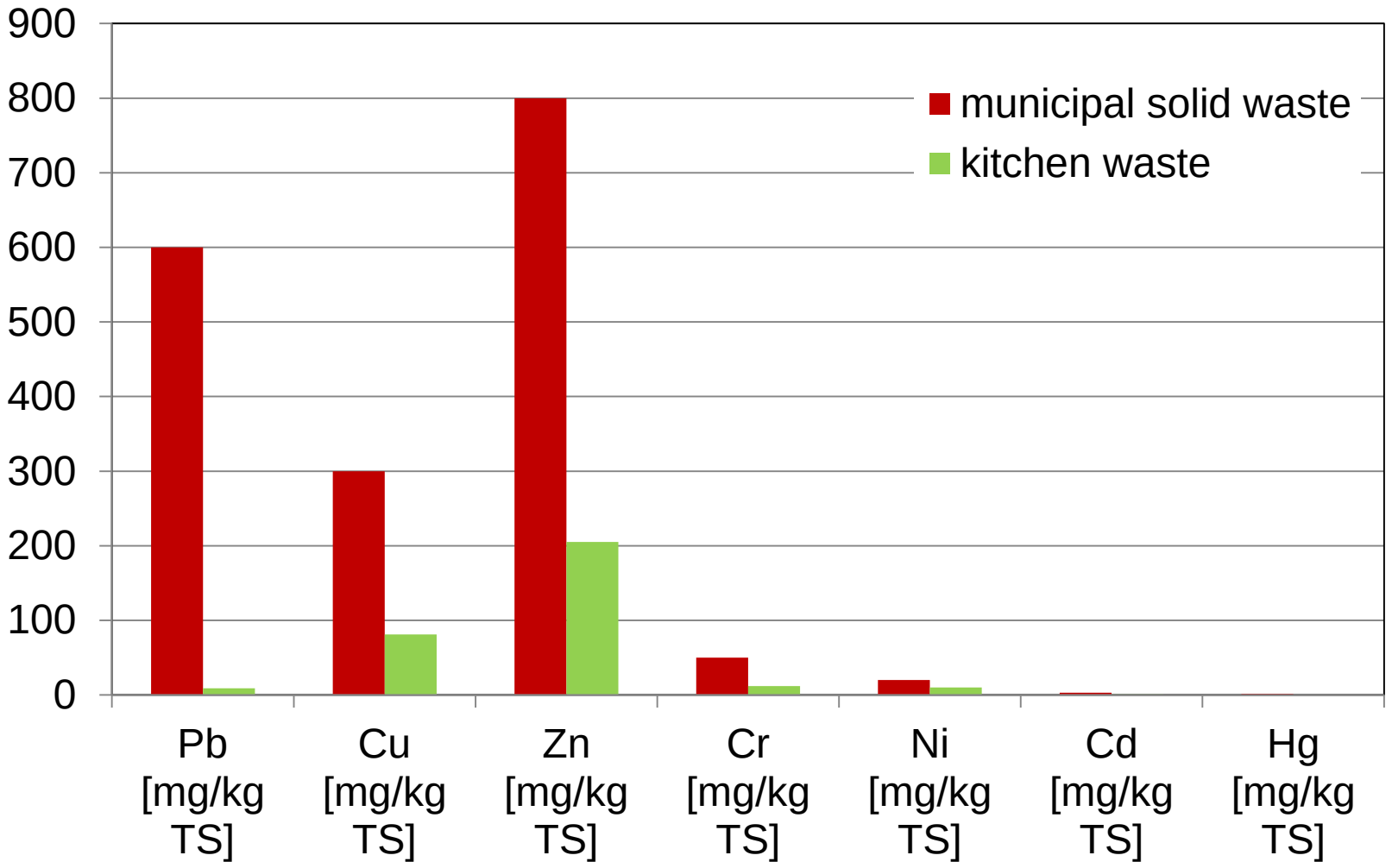
Use of digestate in Germany



Content of heavy metals in Germany



Source: Krauß and Krauß 1995; Schadstoffdetektion am Bioabfall-Sammelfahrzeug. In: Biol. Abfallbehandlung II

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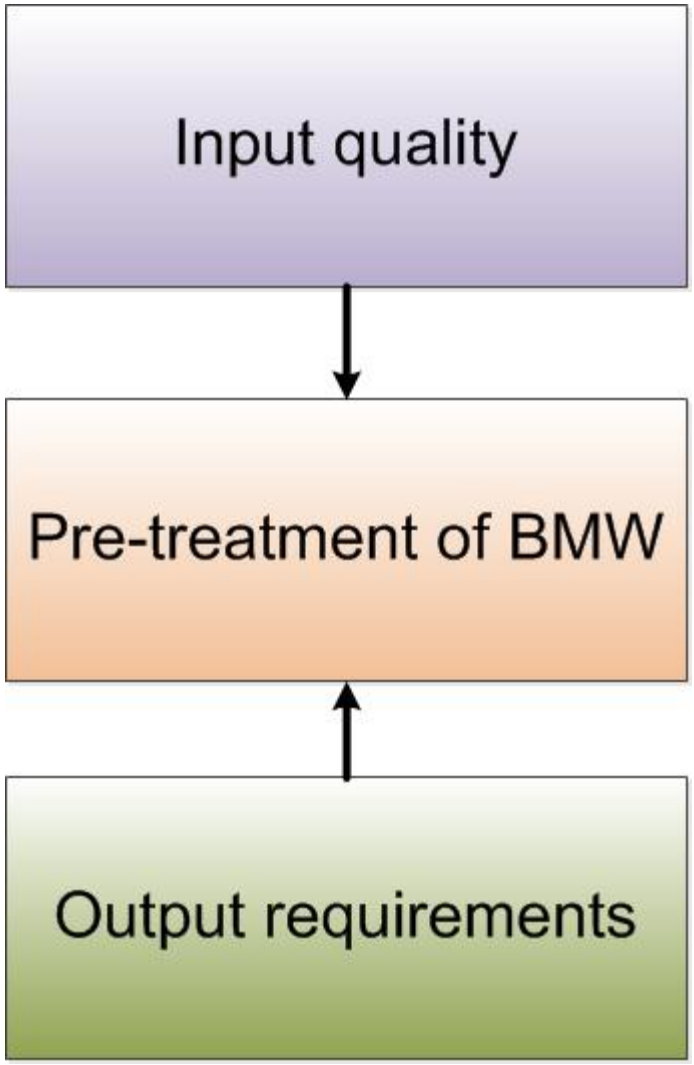
Main Question:

What do you want to do with the output (digestate) of the biogas plant ?

Pre-treatment



Municipal solid waste (MSW) in China

Amount recoverable matter:

- Organic matter 78%
- Wood 1%
- Paper 6,5%
- Plastic 6,8%
- Glass 1,5%
- Metall 0,3%

All in all there is a poor data basis for BMW in China!

Source: Raninger et al. 2011, In: Biogas Engineering and Application

Comparison of **B**iodegradable **M**unicipal **W**aste between China and Germany

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	Chinese BMW	German BMW (City)	German BMW (Rural)
Dry matter content	mean	high 25%	higher 25-35%
Garden waste	- 2,1% wood/bamboo (Ranninger 2007)	mean amount (depending on location)	high amount
Contamination	low	high	low
Seasonal variation	depending on climate	high	high
Salinity	high	mean	low
Compostibility	bad	not so good	good
digestability	good	treatment needed	not good

Chinese BMW in Comparison to European Organic Waste Definitions

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Dry fermentation **wet fermentation**

Green cut
biowaste (rural)
Biowaste (city)
organic industrial waste
kitchen waste
food waste
waste of restaurants
waste slaughterhouse
liquid organic waste

Chinese BMW

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Main Question:

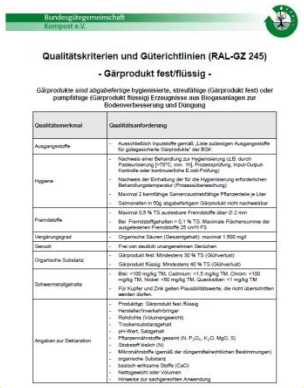
Good quality of output (digestate) - What does this mean ?

Digestate quality criteria in Germany

Digestate used as fertilizer need to fulfill the following criteria (RAL GZ 251)

- Sanitation — <2 seeds/l, no Salmonella
- Contamination — < 0,5 % dry matter content
- Grade of degradation — <1500 mg organic acids/l
- Odor — no bad smell
- Heavy metals — specific limits , for example <100 mg/kg Pb

Pre-treatment influence the quality of digestate!


Bundesgütegemeinschaft Kompost e.V.

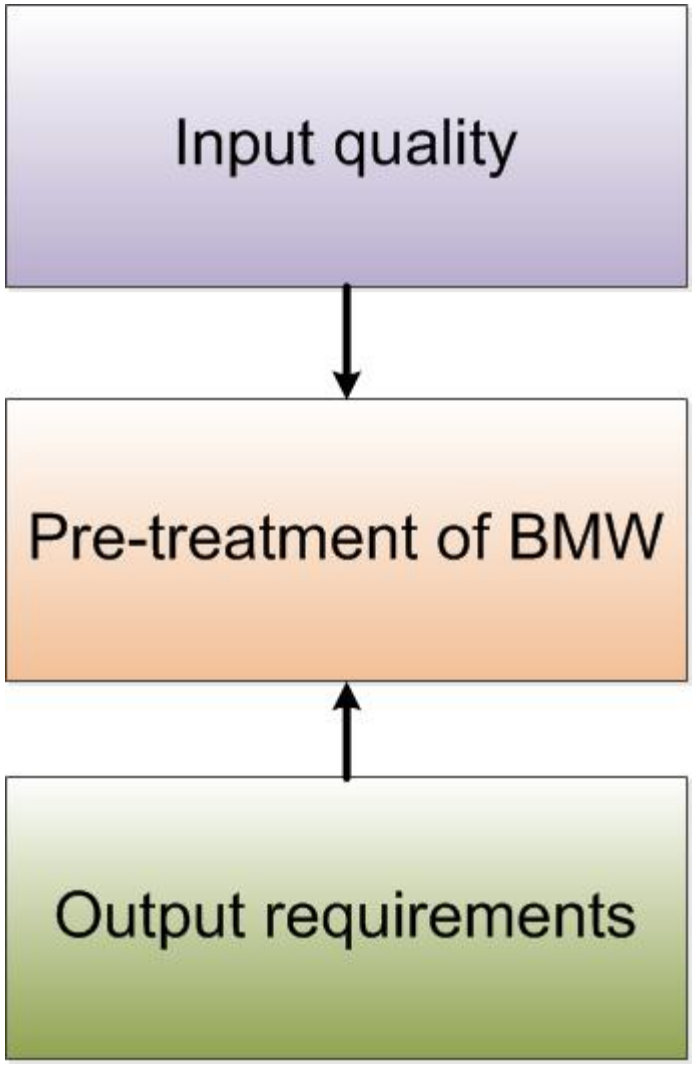
Qualitätskriterien und Gütericht linien (RAL-GZ 245)

- Gärprodukt fest/flüssig -

Gärprodukte sind abgabefertige hygienisierte, streufähige (Gärprodukt fest) oder pumpfähige (Gärprodukt flüssig) Erzeugnisse aus Biogasanlagen zur Bodenverbesserung und Düngung

Qualitätsmerkmal	Qualitätsanforderung
Ausgangsstoffe	- Ausschließlich Inputstoffe gemäß „Liste zulässiger Ausgangsstoffe für gütegesicherte Gärprodukte" der BGK
Hygiene	- Nachweis einer Behandlung zur Hygienisierung (z.B. durch Fließerwärmung [>70°C, min. 1h], Prozesssteuerung, Input-Output-Kontrolle oder kontrollierte E.coli-Prüfung) - Nachweis der Einhaltung der für die Hygienisierung erforderlichen Behandlungstemperatur (Prozessüberwachung) - Maximal 2 keimfähige Samen/ausmeistfähige Pflanzenteile je Liter - Salmonellen in 50g abgabefertigem Gärprodukt nicht nachweisbar
Fremdstoffe	- Maximal 0,5 % TS ausliesbare Fremdstoffe über Ø 2 mm - Bei Fremdstoffgehalten > 0,1 % TS: Maximale Flächensumme der ausgelesenen Fremdstoffe 25 cm²/l FS
Vergärungsgrad	- Organische Säuren (Gesamtgehalt): maximal 1.500 mg/l
Geruch	- Frei von deutlich unangenehmen Gerüchen
Organische Substanz	- Gärprodukt fest: Mindestens 30 % TS (Glühverlust) - Gärprodukt flüssig: Mindestens 40 % TS (Glühverlust)
Schwermetallgehalte	- Blei: <150 mg/kg TM, Cadmium: <1,5 mg/kg TM, Chrom: <100 mg/kg TM, Nickel: <80 mg/kg TM, Quecksilber: <1 mg/kg TM - Für Kupfer und Zink gelten Plausibilitätswerte, die nicht überschritten werden dürfen.
Angaben zur Deklaration	- Produktart: Gärprodukt fest /flüssig - Hersteller/Inverkehrbringer - Rohdichte (Volumengewicht) - Trockensubstanzgehalt - pH-Wert, Salzgehalt - Pflanzennährstoffe gesamt (N, P_2O_5, K_2O, MgO, S) - Stickstoff löslich (NL) - Mikronährstoffe (gemäß der düngemittelrechtlichen Bestimmungen) - organische Substanz - basisch wirksame Stoffe (CaO) - Nettogewicht oder Volumen - Hinweise zur sachgerechten Anwendung

Pre-treatment



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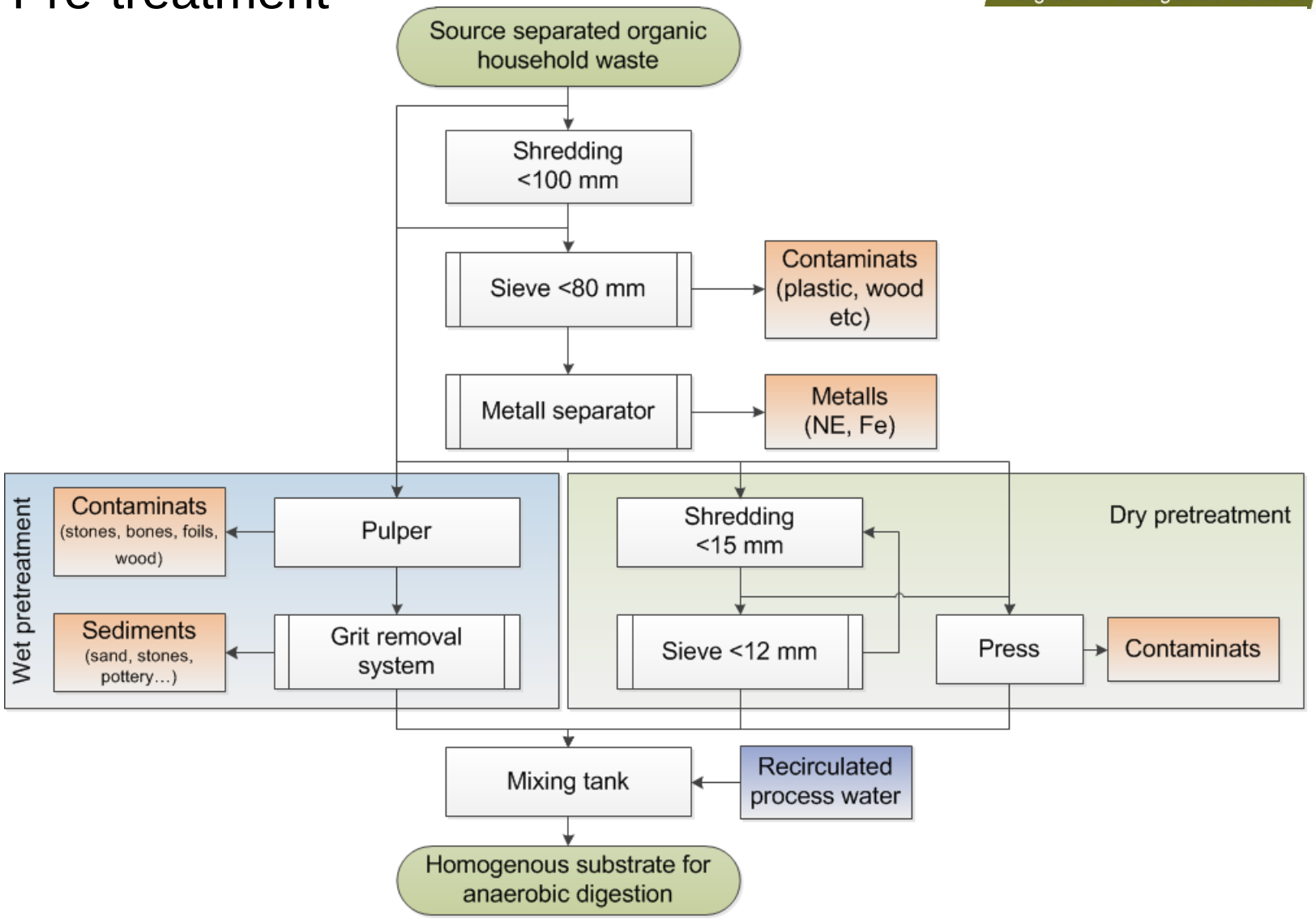
Main Question:

How does a good pre-treatment look like ?

Pre-treatment



Pre-treatment

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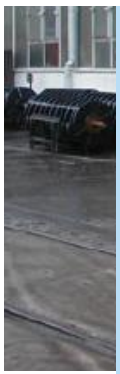

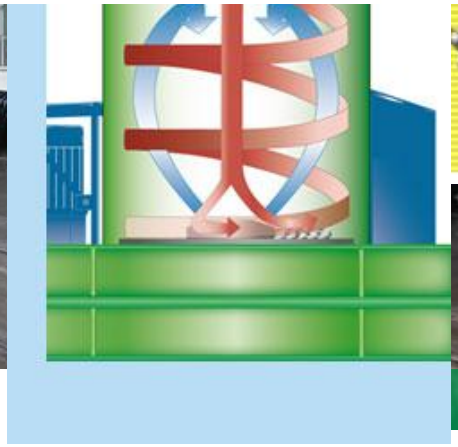

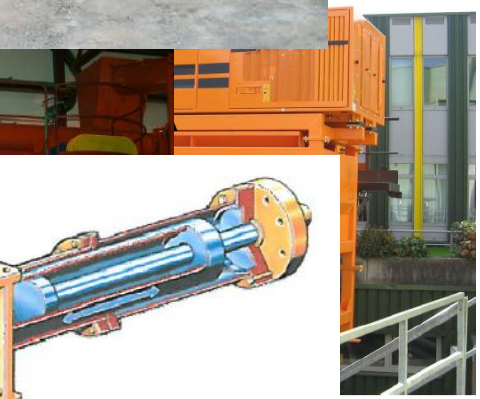

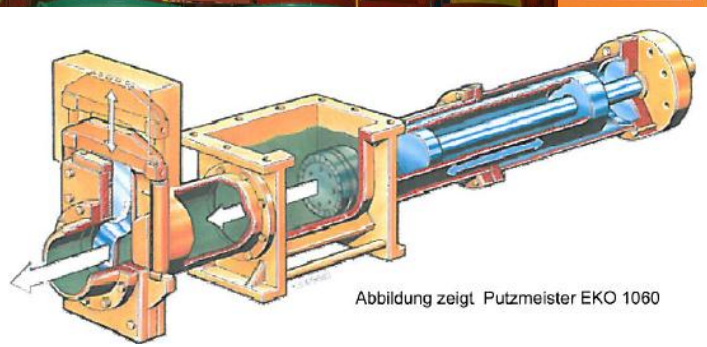

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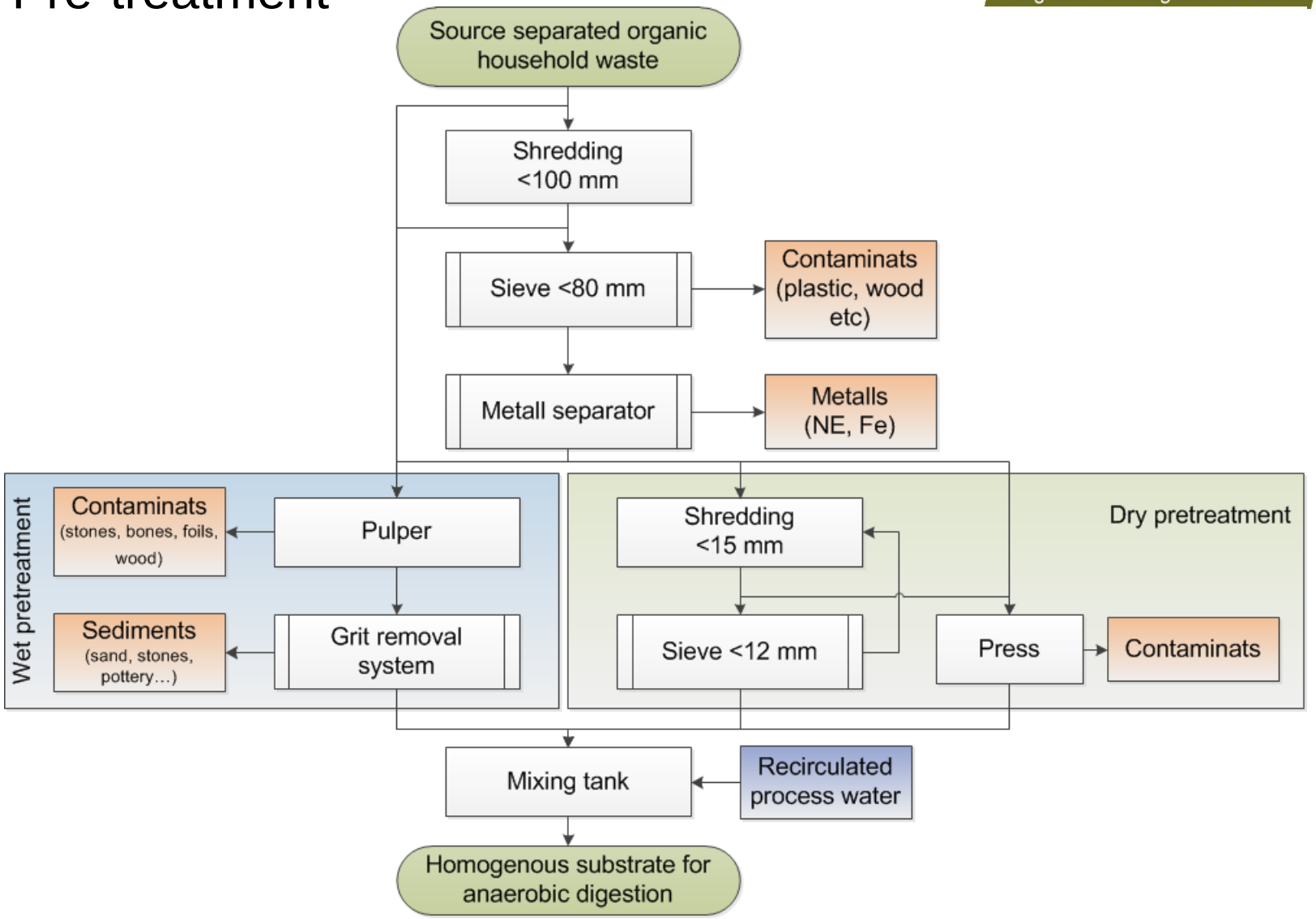
To be paid attention to:

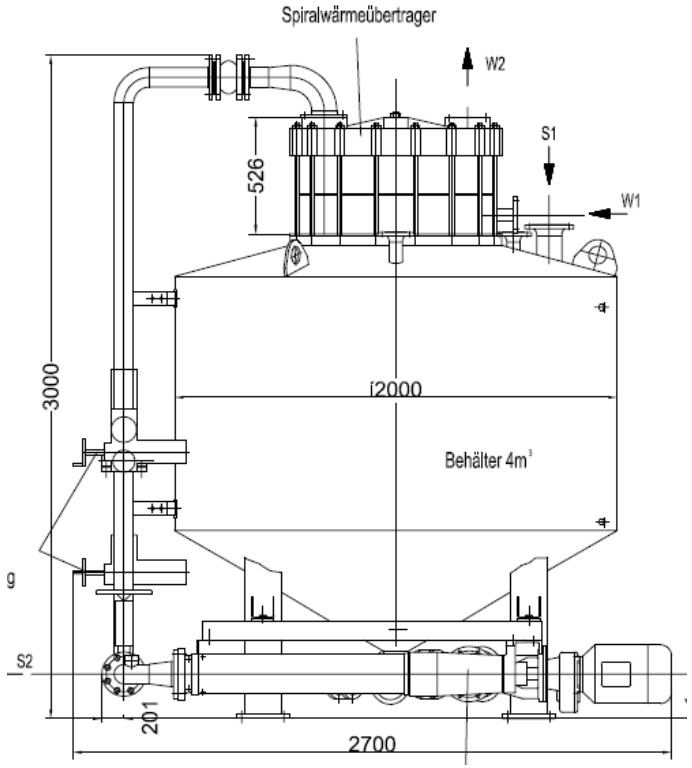
- Season (Summer, Winter, Spring, Autumn)
- City – Rural Areas
- Celebration Days
- Education of People
- Single Family Houses – Skyscrapers
- Area with Habits (North, South, East, West)
- ….

Pre-treatment



Pasteurisation in Germany

Biological municipal waste may contain germs and pathogens, seed and parasites



- Pasteurisation (70° C, 1 h, particel size <12 mm

Type of digestion

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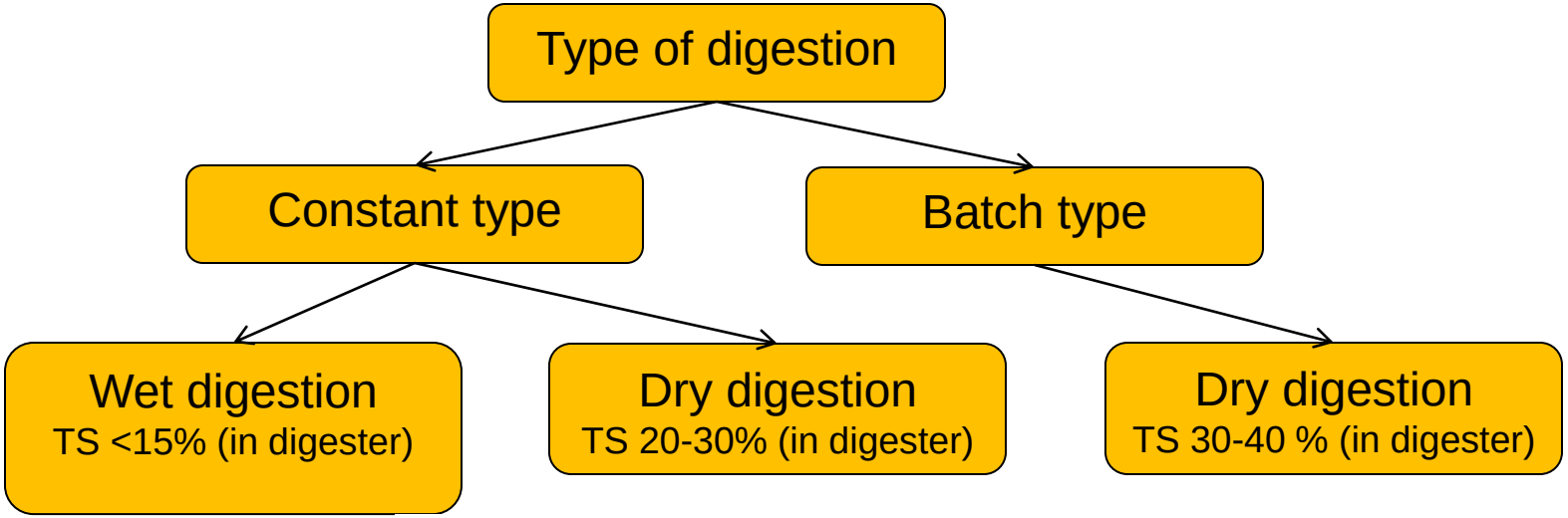
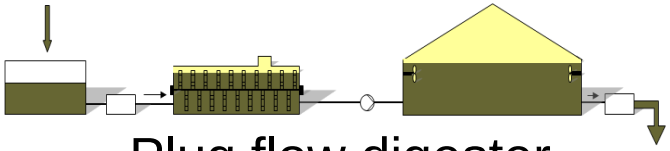
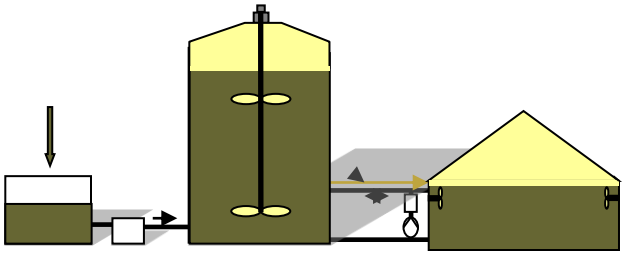
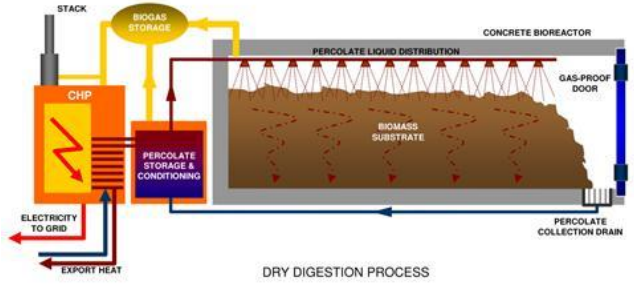




Plug flow digester



Continuous **s**tirred **t**ank **r**eactor (CSTR)(digester)



Garage digester

Chinese BMW in Comparison to European Organic Waste Definitions

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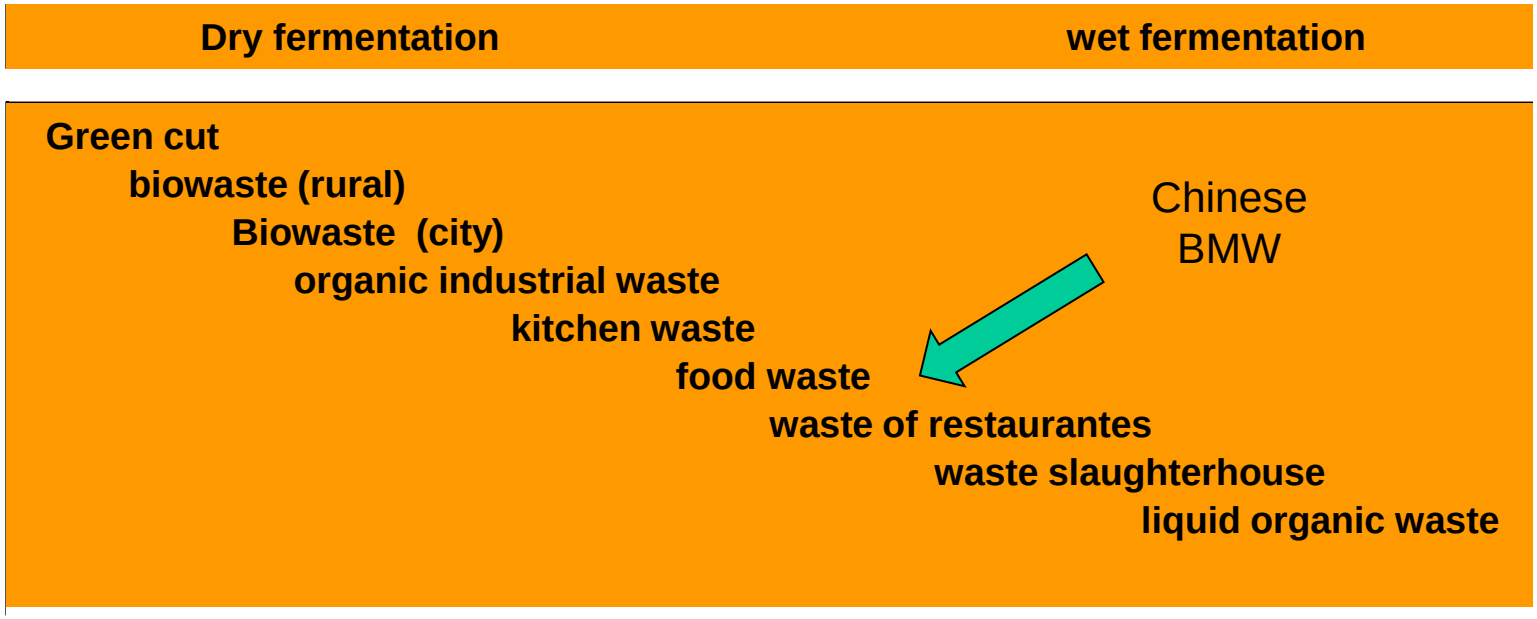

Solid fertilizer from BMW in Germany

- Solid fertilizer from BMW (Göttingen)

Treatment capacity

Depend on

- Total amount of waste delivered [t/a, t/d, t/h]
- Number of working days per annum [250 – 300 ?]
- Number of working hours per day [shifts]
- Operation time of pre-treatment
- Peak amount of delivery (seasonal variation, weekly variation)
- Size of delivery trucks
- Capacity of Reception

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Anaerobic Treatment of Organic Waste from Cities - Lessons learned

- How much BMW per day/week/year ?
- What logistic of delivery ?
- How high shall be the capacity of the reception ?
- What is the input quality ?
- What is the output quality ?
- What pre-treatment ?
- What type of digestion ?

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