

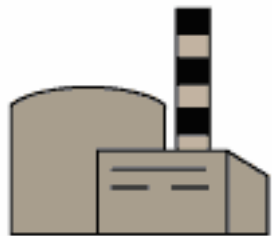
New Solution for Radioactive Waste Treatment by Multiple Fermentation (EMBC-FT)

複合発酵法 (EMBC-FT) による新しい放射性廃棄物
処理技術について

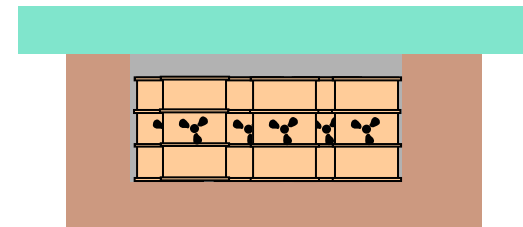
Takashima Institute of Intelligent Technology
高嶋情報開発工学総合研究所

How to deal with “Radioactive Waste Problems” so far? 放射性廃棄物問題へのこれまでの対応

Ex) low-level waste
例) 低レベル廃棄物



Semi-permanent Storage
半永久的な貯蔵



Emission from nuclear power plant
原子力発電所から排出



Separation / Concentration
分離、濃縮



Tightly sealed
密閉容器に封入



Wait for natural radiation decrease
貯蔵し、自然減少を待つ

Safety management
保管中の安全管理

Storage space procurement
保管場所の確保

Storage cost accumulation
保管にかかるコスト

Is it a real solution??
廃棄物問題の解決??

Conventional standpoint for wastes
廃棄物に対する従来の見方

Impossible to decrease radiation
放射能レベルは操作不可能



Separation & Natural decrease
隔離して、自然減少を待つ

Fundamental Cause: No way for positive radiation decrease
根本原因: 放射能を消失できないこと

How should we deal with “Radioactive Waste Problems” from now? 放射性廃棄物問題に対し、今後どう取り組むべきか

Conventional standpoint for wastes
廃棄物に対する従来の見方

Fundamental Cause: No way for positive radiation decrease
根本原因: 放射能を消失できないこと

New standpoint for wastes
廃棄物に対する新しい見方

Coexistence with and Positive use of Radioactivity
放射能と共生し、積極的に利用する方法を探る

Possibility of positive radiation decrease
放射能を消失できる

Strengthen **radioactivity-resistant bacteria** activity to promote decomposing radioactive substances
耐放射性微生物の働きを強化し、放射性物質の分解を促進

Radioactive Substance
放射性物質

Radioactivity-resistant bacteria
耐放射性微生物

Non-radioactive Substance
非放射性物質

Multiple Fermentation
複合発酵法 (EMBC-FT)

Effective Micro-organisms Brewing Cycle –
Fermentation Technology

PRESENTATION PLAN

今日の発表内容

- 1 What is “Multiple Fermentation(EMBC-FT)” ?
複合発酵(EMBC-FT)とは
- 2 Application to low-level radioactive waste
liquid treatment
低レベル放射性廃液処理への応用
- 3 Process and Results of waste liquid treatment
test in Republic of China
台湾での廃液処理実験の内容と結果



Understanding unlimited possibility of EMBC-FT application
複合発酵(EMBC-FT)応用の無限の可能性がわかる

1 What is “Multiple Fermentation(EMBC-FT)” ?
複合発酵 (EMBC-FT)とは

The earth history and Micro-organic activity

地球の歴史と微生物の働き

About 4 billion years ago
誕生当時(40億年前)の地球



Methane, Ammonia, Hydrogen, Steam
メタン、アンモニア、水素、水蒸気

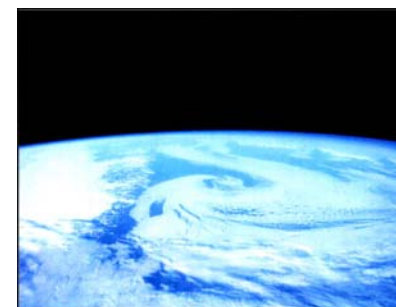
Sulfuric acid, Nitric acid, Heavy metals
硫酸、硝酸、重金属成分

UV, Electron ray, Gamma ray, X-ray
紫外線、電子線、γ線、X線

About 600°C



Present
現在の地球



Atmosphere 大気主成分

Marine 海洋主成分

Comic rays 降下宇宙線

Ave. Temperature 地表温度

Oxygen, Nitrogen, Steam, Ozone
酸素、窒素、水蒸気、オゾン

Salt, Water, Minerals
塩分、水、ミネラル分

Visible radiation
可視光線

About 15°C

Q) What have changed ancient polluted world into the present for 4 billion years?

40億年かけて汚染物質世界を変えてきたものは何？

A) Activities of the micro-organisms that are suitable for the polluted world(That is Natural Self-cleaning Effect).

汚染物質世界に住むのに適した微生物たちが増殖し、自然の自浄作用として物質を変換



EMBC-FT theory's origin:
EMBC-FT理論の原点:

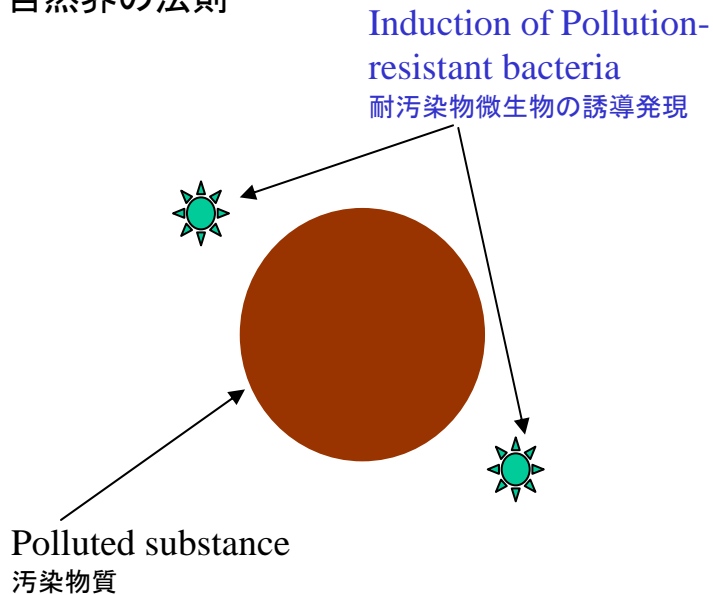
Can we use this power effectively?
この力をうまく利用できないか？

1 What is “Multiple Fermentation(EMBC-FT)” ?
複合発酵 (EMBC-FT)とは

Induction of desirable micro-organic ecosystem by EMBC-FT

EMBC-FTによる好ましい微生物生態系の誘導

Law of the nature
自然界の法則

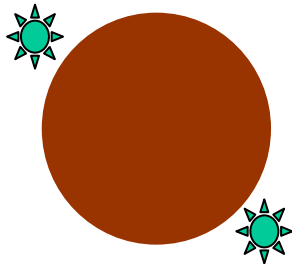


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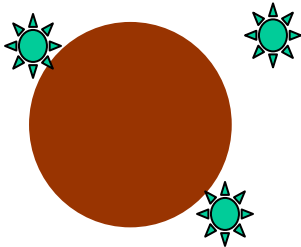


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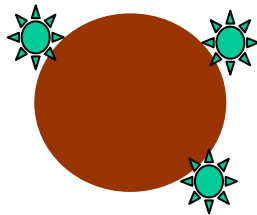


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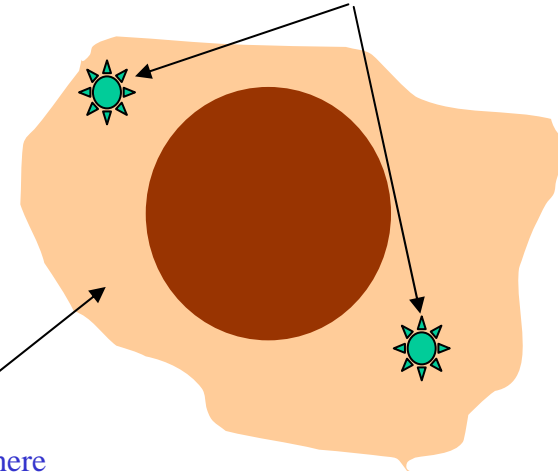
Require long term to decompose
分解に長い期間が必要

EMBC-FT condition
複合発酵状態

Pretreatment for
EMBC condition
複合発酵誘導のため
の事前処理



Induction of Pollution-
resistant bacteria
耐汚染物微生物の誘導発現



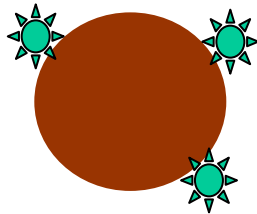
EMBC-FT atmosphere
複合発酵雰囲気

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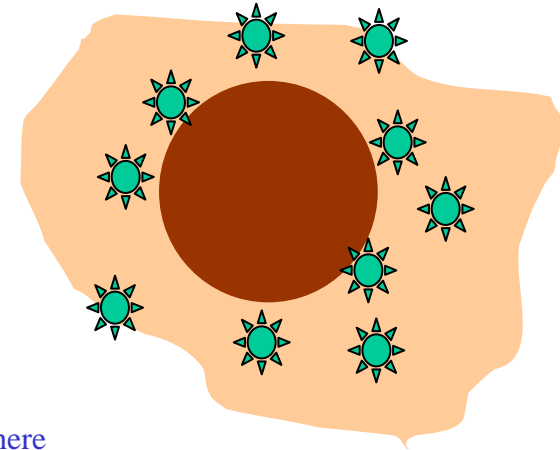
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Require long term to decompose
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EMBC-FT condition
複合発酵状態



EMBC-FT atmosphere
複合発酵雰囲気

Almost zero at micro-organic death rate
微生物の死滅率をほぼゼロ化



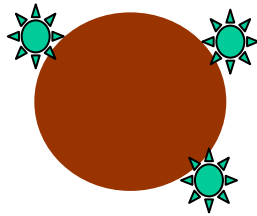
Infinite proliferation
無限増殖が可能

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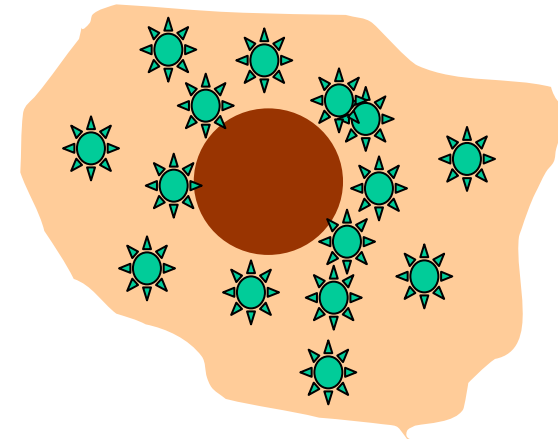
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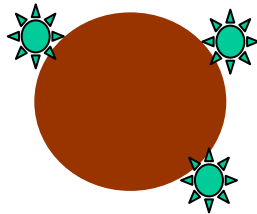


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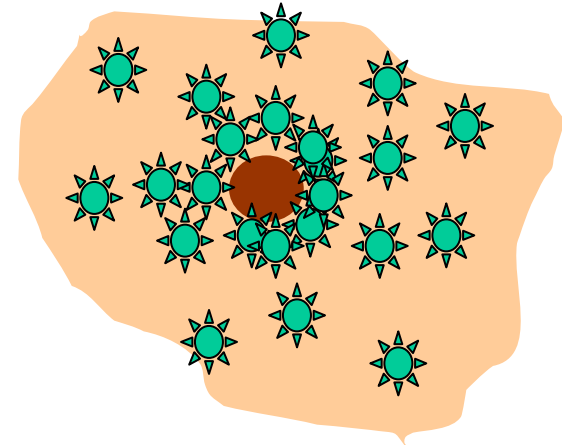
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Law of the nature
自然界の法則



Require long term to decompose
分解に長い期間が必要

EMBC-FT condition
複合発酵状態



Promote to decompose rapidly
分解がすみやかに進行する

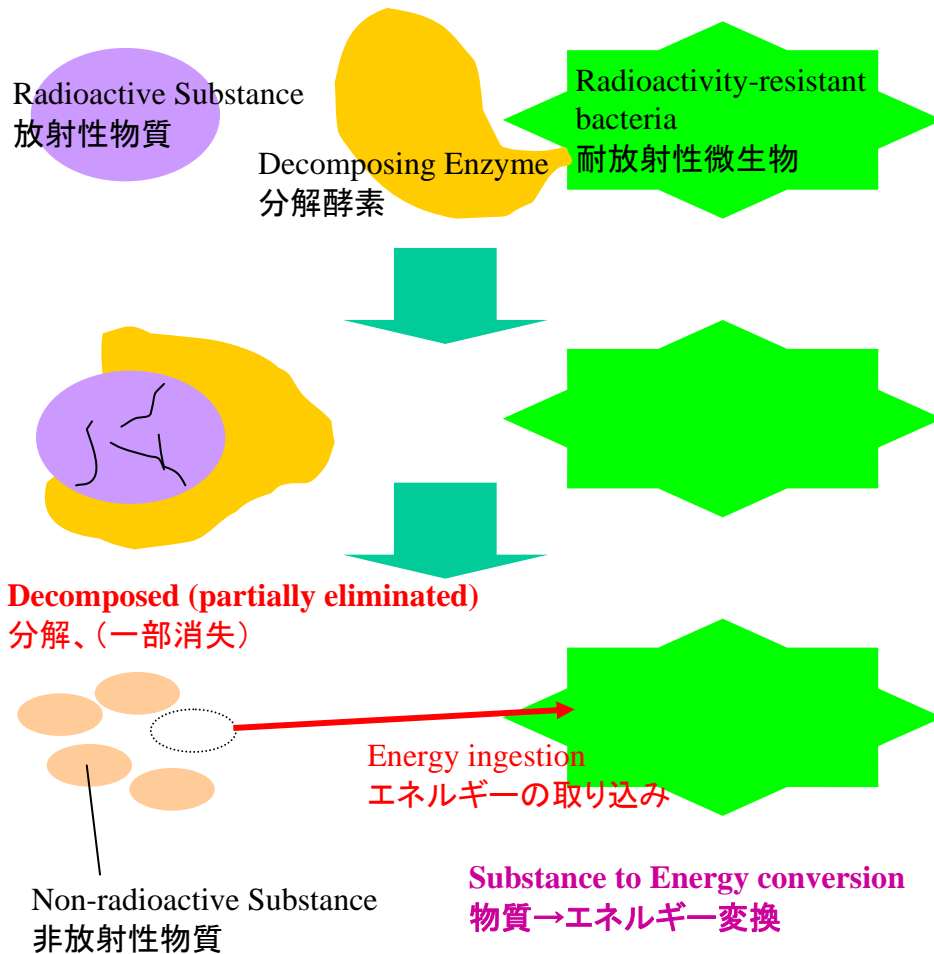


EMBC-FT enables ultimate increase in the natural self-cleaning effect
EMBC-FTは、自然の持つ浄化作用を極限まで高める方法である。

2 Application to low-level radioactive waste liquid treatment
低レベル放射性廃液処理への応用

Activities of radioactivity-resistant bacteria

耐放射性菌の活動



Examples of Radioactivity-resistant bacteria 耐放射性菌の例

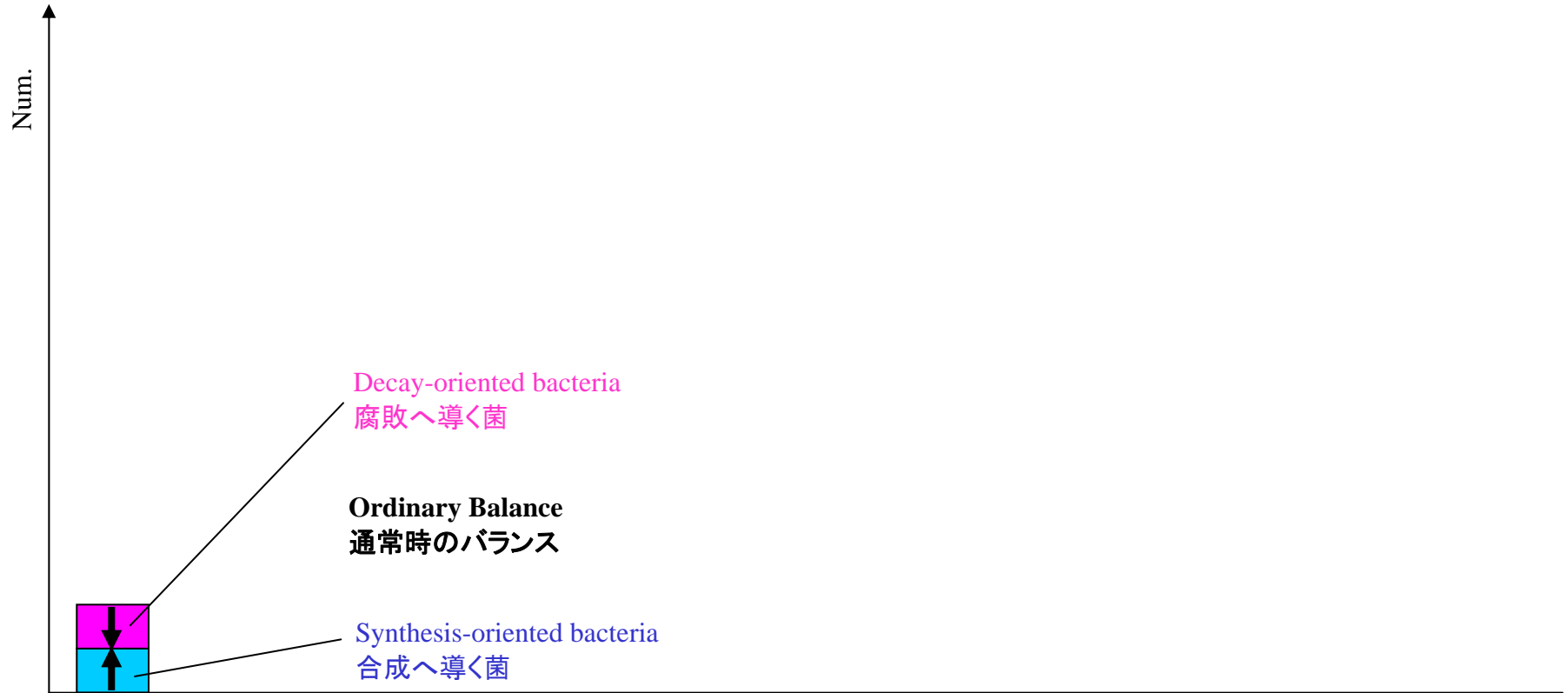
Genus	Type
<i>Acinetobacter</i>	radioactivity-resistant bacteria
<i>Arthrobacter radiotolerance</i>	radioactivity-resistant bacteria
<i>Bacillus cereus</i>	radioactivity-resistant bacteria
<i>Bacillus pumilus</i>	radioactivity-resistant bacteria
<i>Bacillus subtilis</i>	radioactivity-resistant bacteria
<i>Candida albicans</i>	radioactivity-resistant yeast
<i>Candida ciferrll</i>	radioactivity-resistant yeast
<i>Candida krusei</i>	radioactivity-resistant yeast
<i>Chroococcidiopsis</i>	radioactivity-resistant cyanobacteria
<i>Clostridium botulinum</i>	radioactivity-resistant bacteria
<i>Clostridium perfringens</i>	radioactivity-resistant bacteria
<i>Cryptococcus neoformans</i>	radioactivity-resistant yeast
<i>Deinobacter grandis</i>	radioactivity-resistant bacteria
<i>Deinococcus proteolyticus</i>	radioactivity-resistant bacteria
<i>Deinococcus radiodurans</i>	radioactivity-resistant bacteria
<i>Deinococcus radiophilus</i>	radioactivity-resistant bacteria
<i>Deinococcus radiopugnans</i>	radioactivity-resistant bacteria
<i>Dunaliella bardawil</i>	radioactivity-resistant green algae
<i>Erwinia</i>	radioactivity-resistant bacteria
<i>Escherichia coli</i>	radioactivity-resistant bacteria

2

Application to low-level radioactive waste liquid treatment
低レベル放射性廃液処理への応用

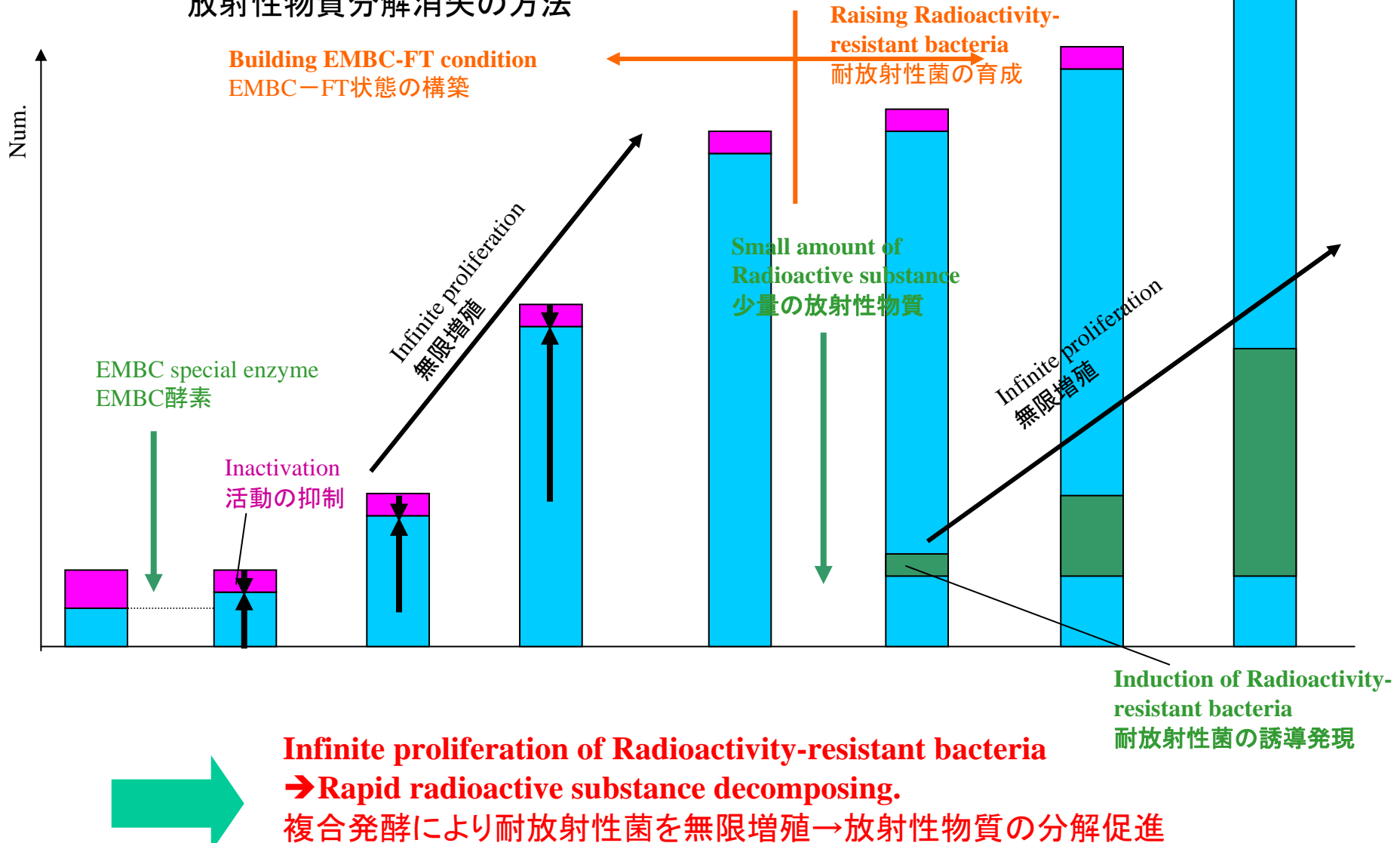
Process to eliminate radioactive substances

放射性物質分解消失の方法



Application to low-level radioactive waste liquid treatment
低レベル放射性廃液処理への応用

Process to eliminate radioactive substances 放射性物質分解消失の方法

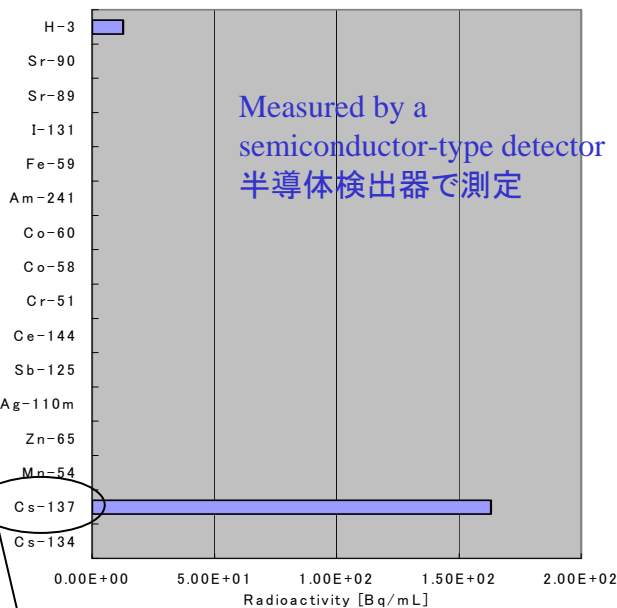


3 Process and Results of waste liquid treatment test in Republic of China
台湾での廃液処理実験の内容と結果

Test conditions

実験条件

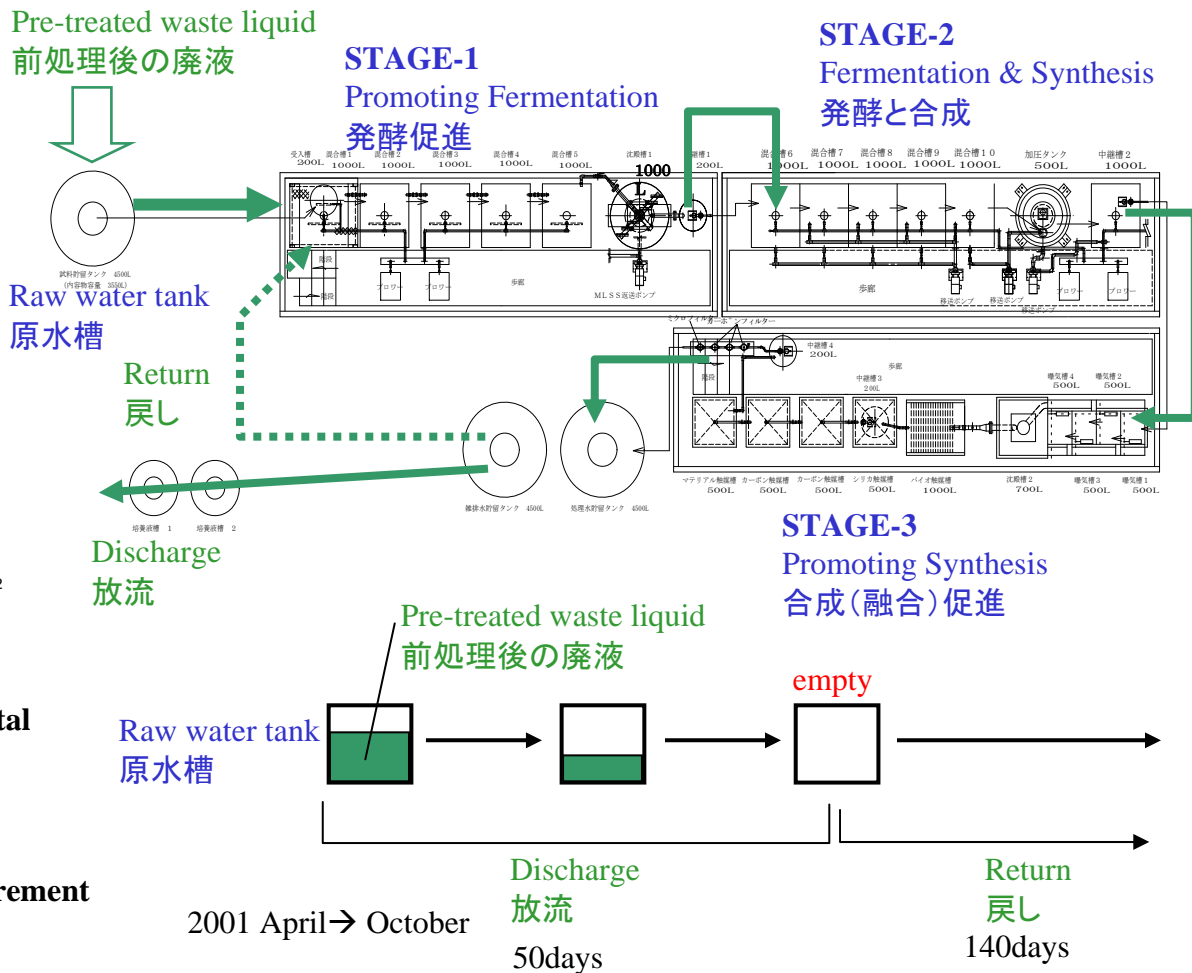
Nuclide in the waste liquid
廃液に含まれる核種



Cs-137 radioactivity occupies over 90% of total
セシウム137の放射活度が全体の9割以上

Estimate total radioactivity by Cs-137 measurement
セシウム137の値をほぼ全体値とみなす。

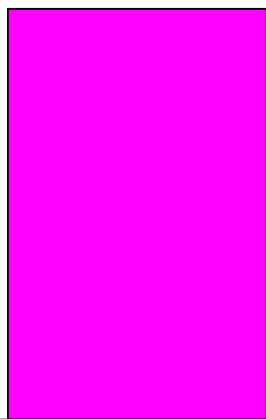
Processing flow in the pilot plant
処理プラントでの流れ



Process and Results of waste liquid treatment test in Republic of China
台湾での廃液処理実験の内容と結果

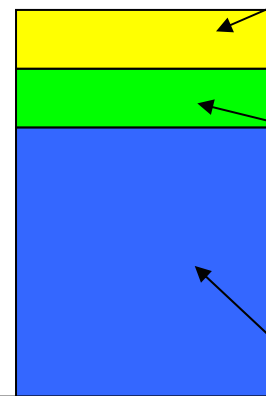
Demonstration method of treatment effect 処理効果の検証方法

Sum of Cs137 radiation in injected waste liquid
全投入廃液中のCs137放射能



=
Or
>

Sum of Cs137 radiation in discharged water and inside tanks of the plant
放流水中、プラント中の全Cs137放射能



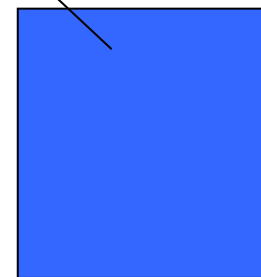
Sum in sampled liquid
測定サンプル液中の全Cs137放射能



Sum in washing waste liquid
タンク内洗浄廃液中の全Cs137放射能



Sum in discharged water and inside-tank liquid
放流水中、タンク内処理中液の全Cs137放射能



= Σ (Total amount 液量合計) ×
(Specific Cs137 radioactivity
単位液量あたりの放射量)

Elimination is possible
消失は可能

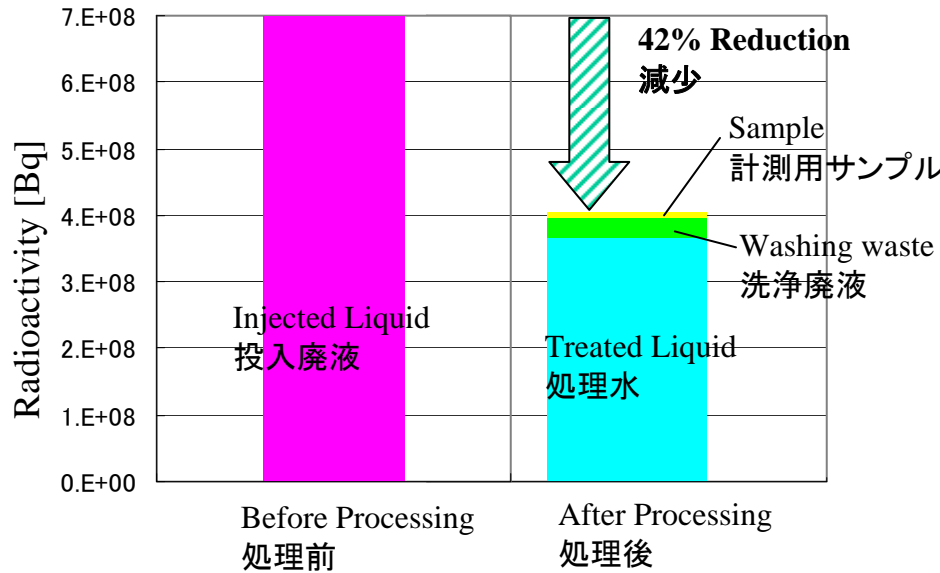
Σ : Summation of daily value
日数での和

Process and Results of waste liquid treatment test in Republic of China
台湾での廃液処理実験の内容と結果

Test results 実験結果

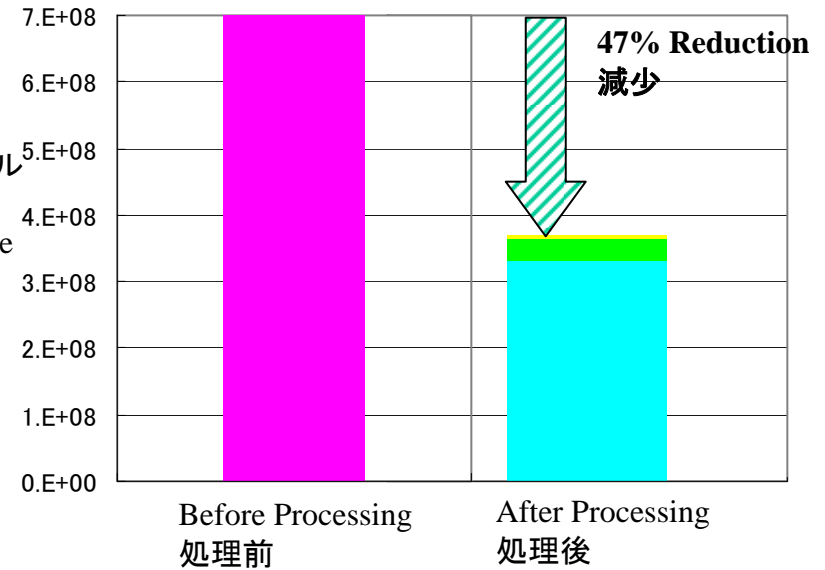
CASE-1

Estimating total liquid volume from tank drawings
各槽内の水量を図面から算出した場合



CASE-2

Measuring total liquid volume with a measurement tank
各槽内の水を計量槽に移して測定した場合



EMBC-FT processing enables to decompose and eliminate 42-47% of radioactive substances

EMBC-FT処理方法により放射性物質量の42~47%を分解消失

CONCLUSION

まとめ

1

What is “Multiple Fermentation(EMBC-FT)” ?
複合発酵 (EMBC-FT)とは



Effective method to increase the natural self-cleaning effect ultimately

微生物による自然の自浄作用を極限まで高める手法

2

Application to low-level radioactive waste liquid treatment
低レベル放射性廃液処理への応用



Decomposing radioactive substances using infinite induction and proliferation of radioactivity-resistant bacteria

耐放射性菌を誘導発現、無限増殖させることで放射性物質を分解

3

Process and Results of waste liquid treatment test in Republic of China
台湾での廃液処理実験の内容と結果



Over 40% of radioactive substances have been eliminated.

廃液中の放射性物質量の4割以上を分解消失



New solution approach to various difficult problems by EMBC-FT application
複合発酵 (EMBC-FT)を活用する、各種難問題への新しい解決アプローチの存在