

Characterization of Core Microbiota and Methane-Related Functional Genes associated with Methane Emissions and Growth Performance in Cattle

곽민진

Kwak, Min-Jin

(국민대학교)

(Kookmin University)

Curriculum Vitae

- ▶ 2025~현재 국민대학교 임산생명공학과 조교수
- ▶ 2024~2025 University of Florida 박사 후 연구원
- ▶ 2022~2024 서울대학교 연구조교수
- ▶ 2021~2022 고려대학교 연구교수
- ▶ 2015~2021 고려대학교 생명공학과 석박사통합과정
- ▶ 2008~2015 고려대학교 생명공학부 이학사



Characterization of Core Microbiota and Methane-Related Functional Genes Associated with Methane Emissions and Growth Performance in Cattle

Min-Jin Kwak, Ph. D.
Department of Forest Products and Biotechnology
Kookmin University



Introduction



Global warming

Fire disaster



Global warming breached 1.5°C threshold in 2024

Annual global average temperatures, compared to the 1850-1900 pre-industrial period. °C

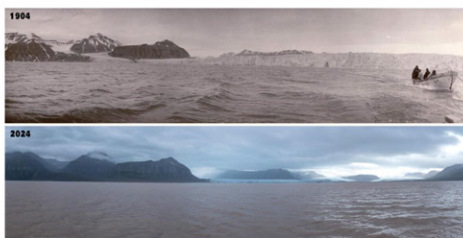


By Kate Abnett • Source: Copernicus Climate Change Service



Global warming

Flood disaster

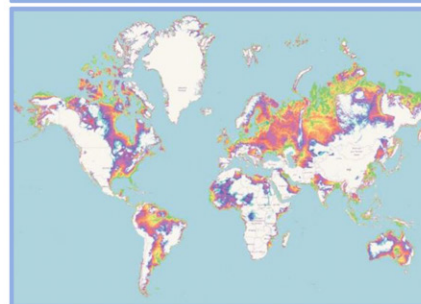
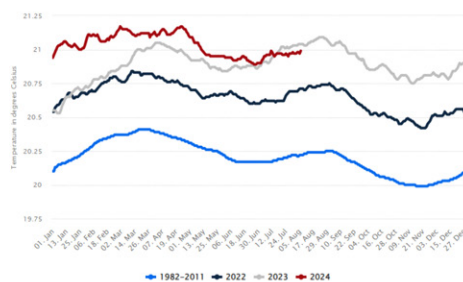
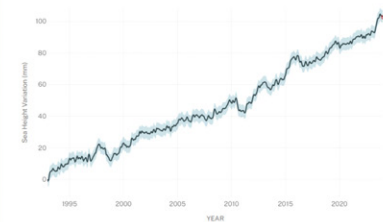


SATELLITE DATA: 1993-PRESENT

Data source: Satellite sea level observations. Credit: NASA's Goddard Space Flight Center

RISE SINCE 1993

↑103.3 millimeters

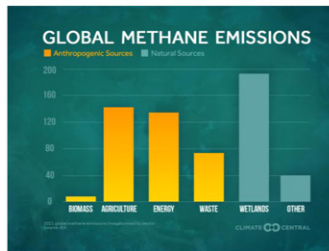
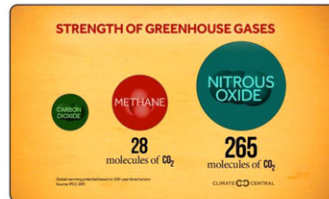
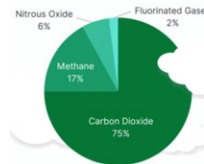
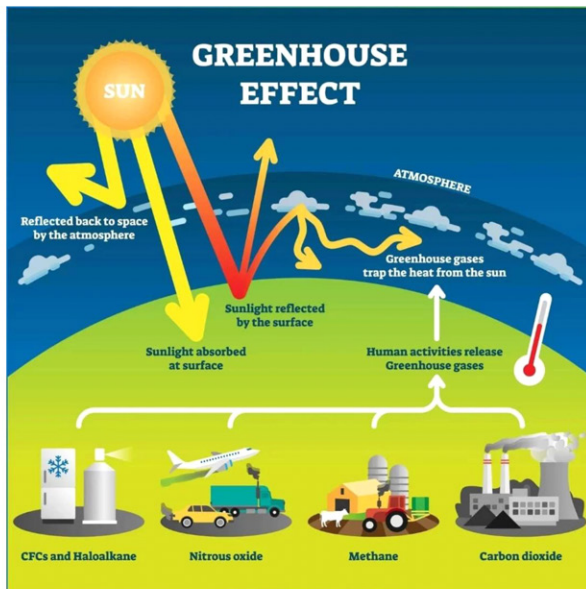


(España et al., 2024)



Greenhouse gases

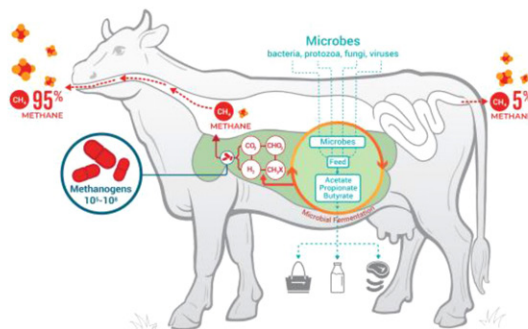
- **Greenhouse gases:** gases in the earth's atmosphere that trap heat



Global Methane Pledge in livestock



- Reduce **methane emissions** by 30% below 2020 levels until 2030
- If successful, warming is projected to decrease by 0.2°C by 2050
- 160 countries signed up to GMP



- ANIMAL & FEED MANAGEMENT**
- Feed processing
 - Genetic selection
 - Improving animal health
 - Improving pasture management
 - Increasing feeding level
 - Increasing forage quality
 - Optimizing temperature
 - TMR feeding
- DIET FORMULATION**
- By-products
 - Decreasing forage-to-concentrate ratios
 - Minerals and salts
 - Oils and fats
 - Oilseeds
 - Increasing protein
 - Tanniferous forages
 - Urea
- RUMEN MANIPULATION**
- Additives
 - Defaunation
 - Electron sinks

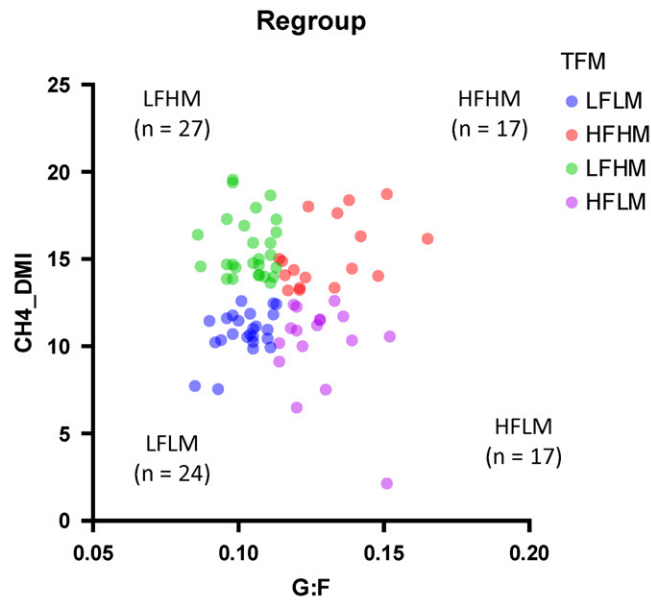


Results



Results

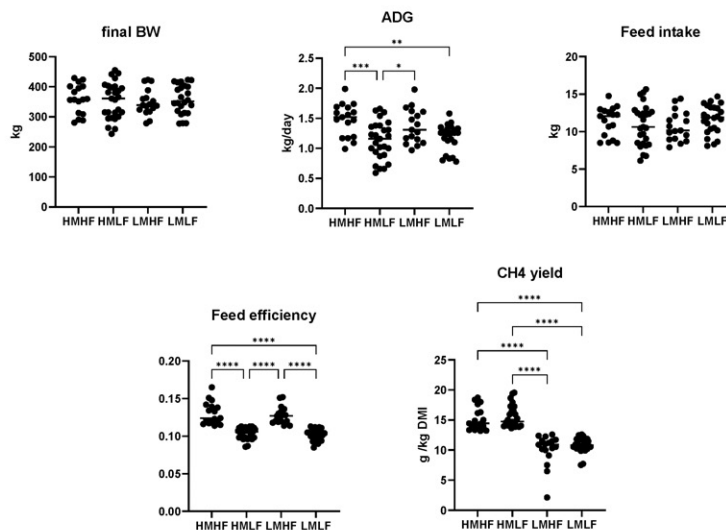
- Characterization of experimental treatments based on FE and Methane yields





Results

- Physiological results of cattle

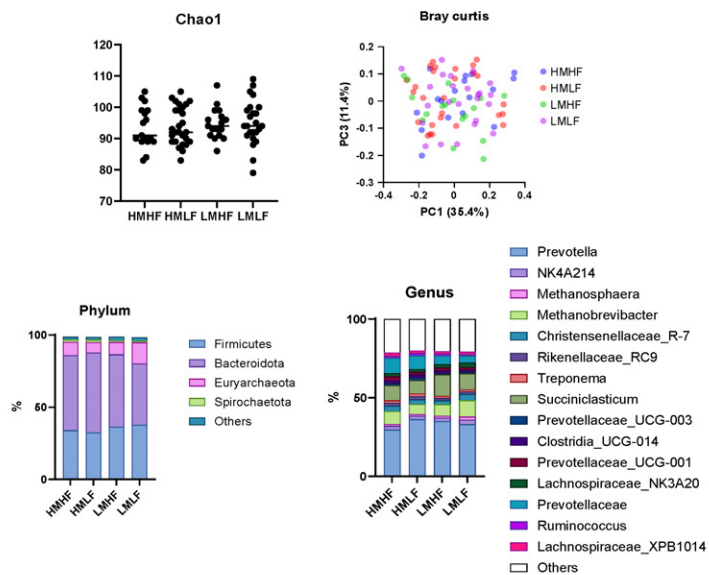


9



Results

- Rumen microbiome analysis

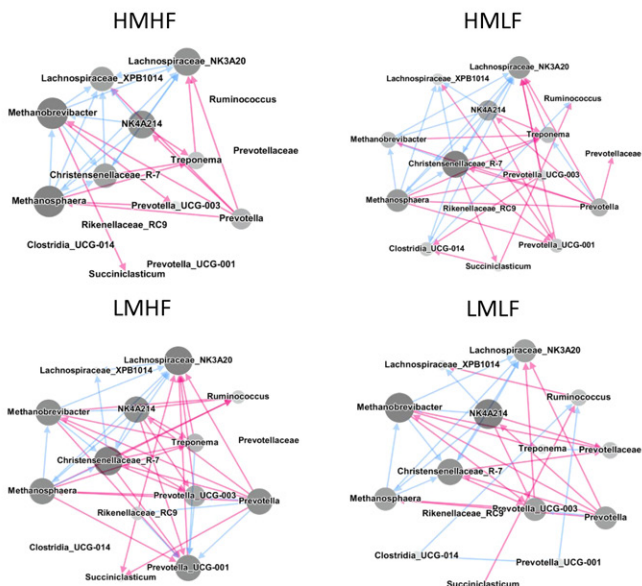


10



Results

- Co-occurrence network of rumen microbiome

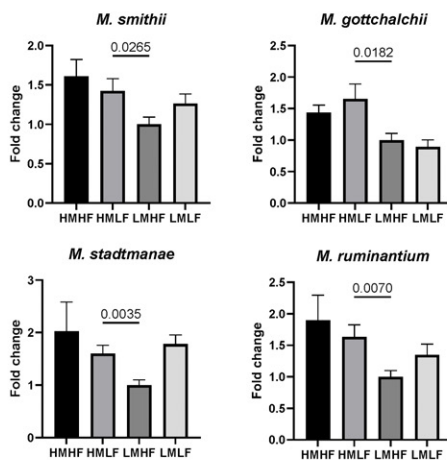


11



Results

- qPCR analysis related to methanogen

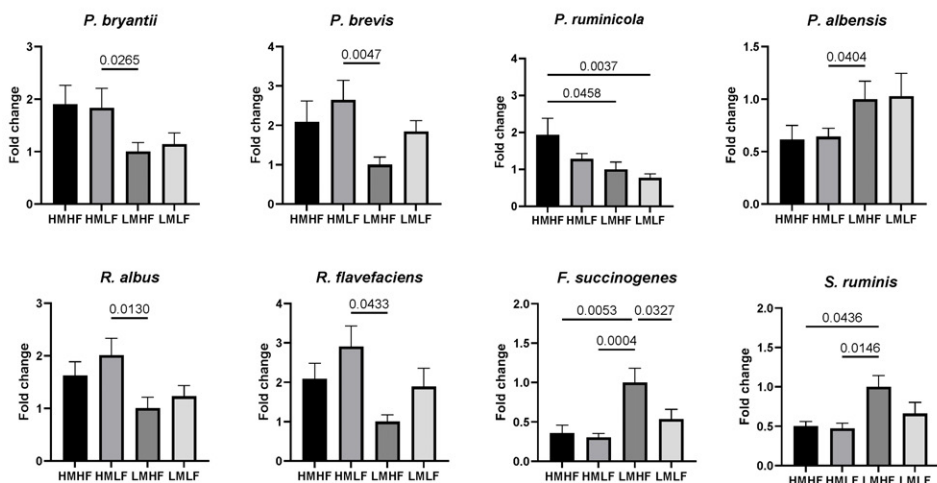


12



Results

- qPCR analysis related to methane-producing bacteria

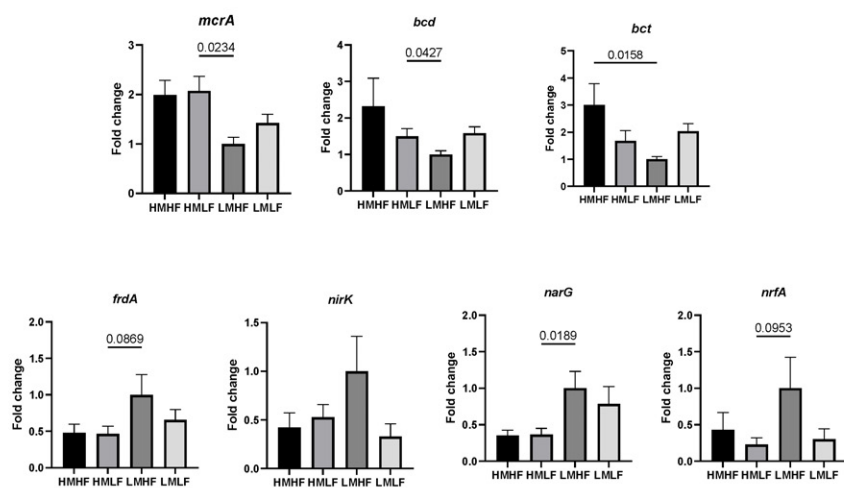


13



Results

- qPCR analysis related to methane-producing genes

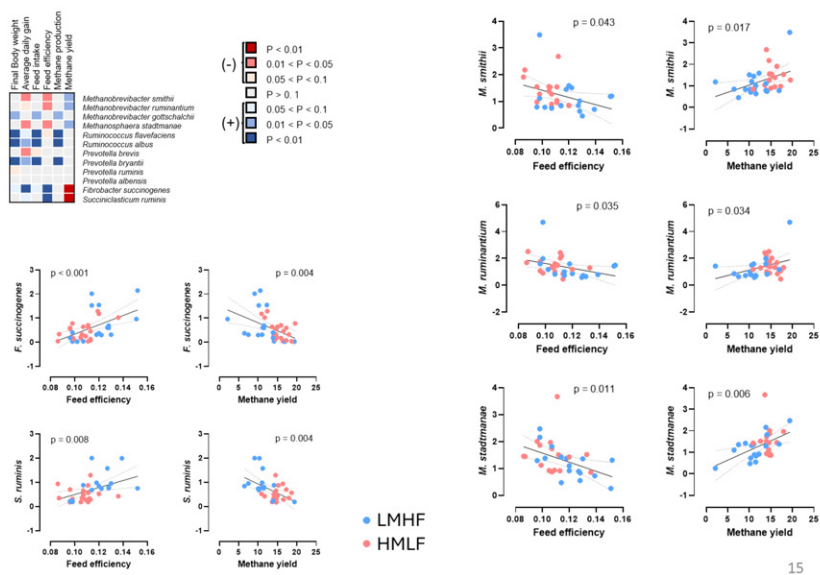


14



Results

- Correlation analysis of physiology results and rumen methanogen

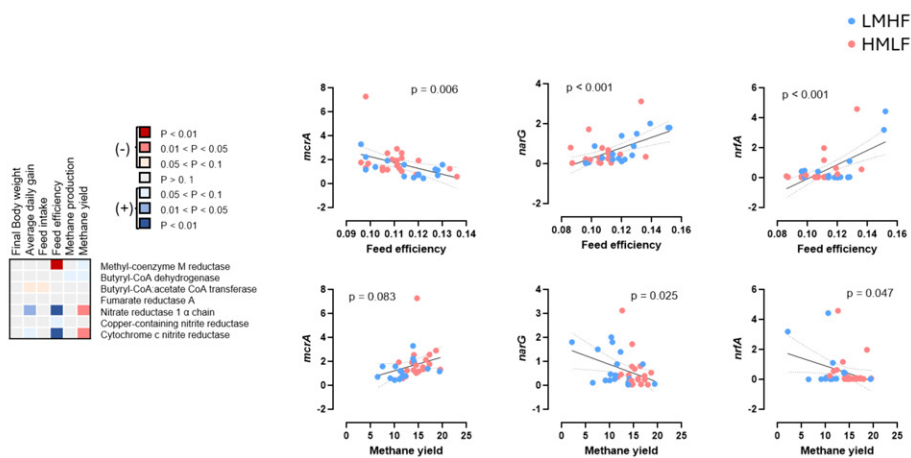


15



Results

- Correlation analysis of physiology results and methane-related genes

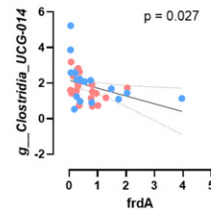
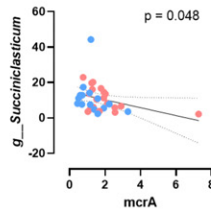
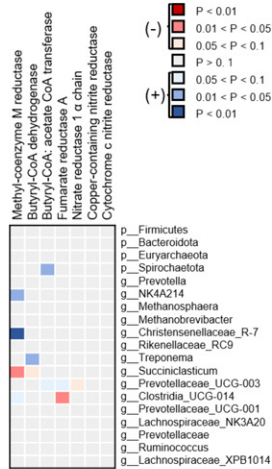


16



Results

- Correlation analysis of methane-related genes and rumen microbiome



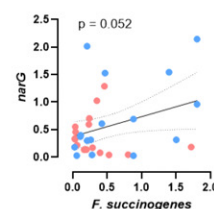
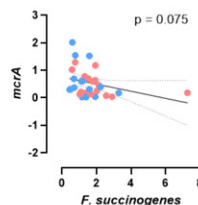
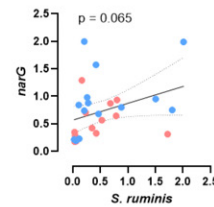
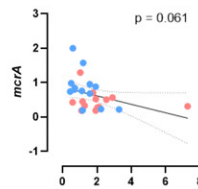
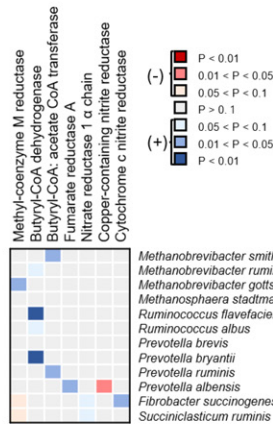
• LMHF
• HMLF

17



Results

- Correlation analysis of methane-related genes and rumen methanogen

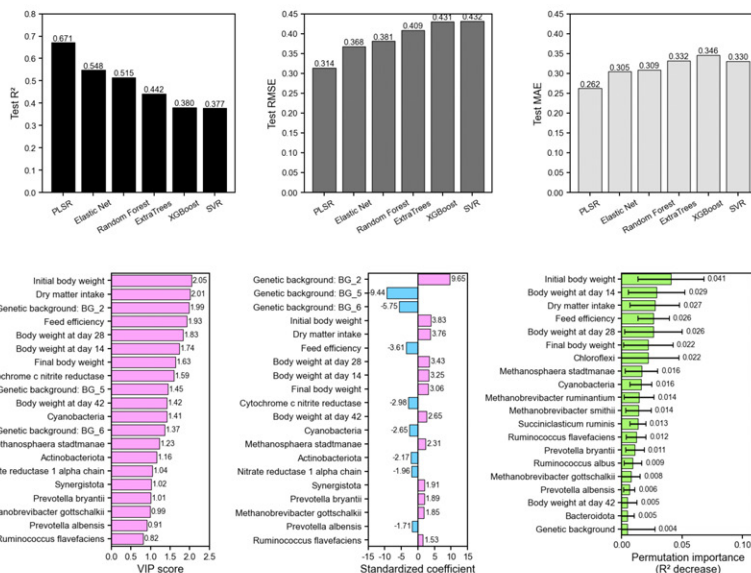


18



Results

- Machine learning analysis to predict methane yield

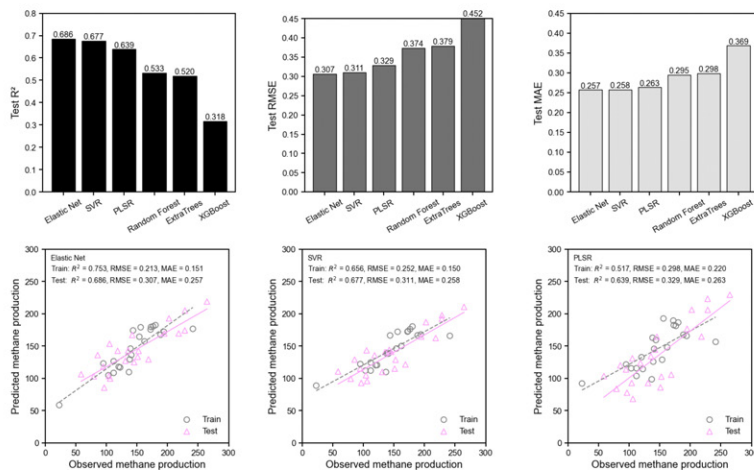


19



Results

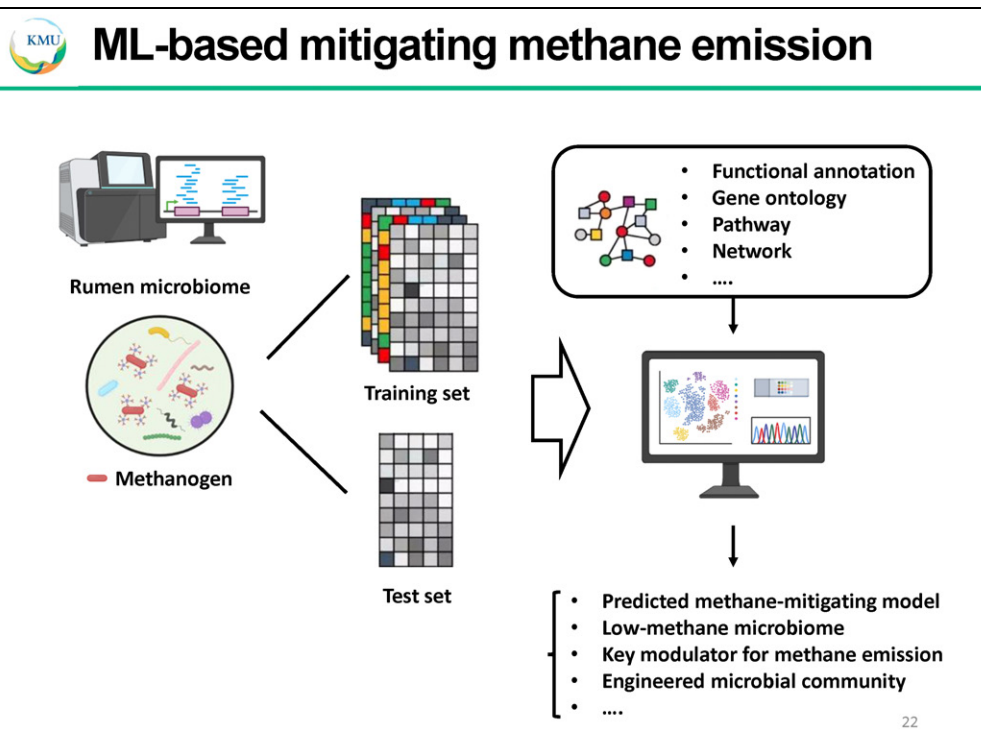
- Machine learning analysis to predict methane yield



20



Conclusion & Perspectives



**THANK YOU
FOR YOUR ATTENTION!!!**



ANY QUESTION ?