The benefits and barriers of Whole Genome Sequencing for pathogen source tracking: a food industry perspective

19th May 2022
Adrianne Klijn
Food Industry Workshop

NAVIGATING THE BENEFITS AND BARRIERS OF WHOLE GENOME SEQUENCING FOR PATHOGEN SOURCE TRACKING

Wednesday 4th September 2019
Companies participating to survey/workshop
Food Industry Forum

Quarterly on-line meetings

Composition
- Food companies (22 companies)
- Academia (3)
- Laboratories, method suppliers (9)

Several sub forums
- Metagenomics
- General microbiology methods
- Probiotics
Who is using WGS

Large majority of food industries participating to survey/workshop (2019) use WGS
Outline

- Introduction
- Benefits
Benefits of WGS

WGS has the highest discriminatory power

Salmonella
Cronobacter
Listeria

Sub typing tools

Serotyping
PFGE
Ribotyping
MALDI-TOF
WGS
Benefits of WGS

This level of discriminatory power is not always needed

Therefore, it is unlikely that WGS will replace all other typing tools in the near future
Benefits of WGS

This level of discriminatory power is not always needed
Only used if other subtyping tools are not sufficient

or:

- particular environmental site,
- product category,
- linked to a specific event.
Benefits of WGS

There are some cases where this level of discriminatory power is needed.

Creating a database of common control strains to speed up the analysis and reduce duplication of sequencing.
Outline

- Introduction
- Benefits
- Models of implementation
Models of implementation

Laboratory part
- DNA extraction
- Sequencing

Bioinformatic part
- Bioinformatic analysis
- Result interpretation

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Models of implementation

Laboratory part is mostly outsourced

Sequencing platforms used:
- Illumina = 14
- Oxford Nanopore = 4
- Pacbio = 4
- ThermoFisher IonTorrent = 3

How do you do WGS - sequencing?
- Developed sequencing in-house
- Using third party lab (outsourcing)
- Both (in house and outsourcing)
Models of WGS implementation

- CAPEX investment needed to build in-house capability
- Fast-evolving sequencing techniques, sequencers can quickly become obsolete.
- Due to the low sample throughput, the cost per analysis is high with a low return on investment for the equipment.
- DNA library preparation and sequencing are not yet automated.
- Shipping isolates to a central place remains a challenge for some countries.
Models of WGS implementation

Bioinformatic part is less outsourced

How do you do the bioinformatic analysis?

- In-house: 6
- Using third party lab (outsourcing): 5
- Both (in house + outsourcing): 5

N=16
Models of WGS implementation

- Lack of method standardization and analyzing the data in-house will ensure a consistent approach.
- Ensure an integrated approach of genomic expertise and food safety management expertise.
Barriers - Regulatory implications

- Regulatory pressure to share WGS data
- Absence of a legal framework
- Lack of clarity on data ownership
Barriers - cost

Sequencing cost has decreased

Yes, but ... the total cost must be considered, including

- Equipment
- IT infrastructure
- Expertise in sequencing, bioinformatics and microbial genomics

WGS in comparison with other typing tools remains expensive
Barriers – Time-To-Result

WGS often provides a retrospective result

More an investigative tool than crisis tool
Interpretation of WGS results requires multiple expertise and is not straightforward.

Historical strains can provide a valuable context.
Barriers – method standardization

Methodology needs to be standardized

ISO 23418:2018(E)
ISO TC 34/SC 9/WG 25
Secretariat: AFNOR

Microbiology of the Food Chain — Whole genome sequencing for typing and genomic characterization of foodborne bacteria — General requirements and guidance
Barriers - proficiency testing

- Independent proficiency test
- Open to all laboratories
- Cover both the laboratory and bioinformatics part
Outline

- Introduction
- Benefits
- Models of implementation
- Barriers
- Outlook
Outlook

- Introduction of WGS has been a game changer
- Permanent feature of food safety management systems
- Advisable that food industries become familiar with WGS
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To join please contact FoodMicrobiologyForum@rdls.nestle.com
Acknowledgement

All participants from workshop and forum