Essential Oils & Biofilms

Essential oils which inhibit the formation of biofilms Núria Carreño Bautista de Lisbona. Degree in Biology. Universitat Autònoma de Barcelona. 2014/2015

Nowadays the excessive use of antibiotics and the extremely aggressive sanitizing treatments has results in the apparition of a biofilm resistant phenotypes. Due to that the scientific community has begun to research for alternatives to traditional biofilm removal techniques.

Structural bio-corrosion paradigm:

Unwanted microbial formations or undesired deposit based on their byproduct activities.

Control strategies: Regular Sanitization
 Development of bio-materials with anti-adherent properties

Involvement

Clinical involvement:

Biofilms generate up to 80% of microbial nfections. They generally develop on body tissues (i.e. skin, mucosity or teeth) and edical care tools (i.e. catheters).

Control Strategies:

- Bactericide and bacteriostatic → anti-
- microbials compounds (prophylactics). Anti-bactericide compound \rightarrow avoids phenotype-resistant microbiology

Food processing industry:

iofilm-bacteria have a higher resistance to isinfectant. Pathogens containing biofilms play a key role in the development of foodborne illness .

The most problematic of those, which

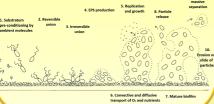
generate spoilage are the psychrotrophic bacteria (they develop at ↓ temperature, ↓ pH and 1 water). Control Strategies:

- Cleanliness
 Sanitization
- 3 Essential Oils
- Biofilm-aware equipment design

Biology

Dynamic process divided in 3 phases:

- a) Adhesion: With reversible and irreversible unions
- b) Growth: Cell division and creation of the 3D structure.
- c) Separation: Which enables the dispersion and colonization of new habitats



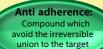
generate longevous colonies of sessile microorganisms in reaction to physical, chemical or biological agents. They adhere irreversibly to a substrate and enclose themselves in a self-produced polymeric matrix. This matrix contains polysaccharides, proteins and extracellular microbial DNA.

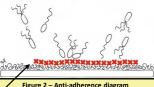
Biofilms become a resistance strategy, for example, against host immunological system and antimicrobial agents. The resultant matrix cannot be phagocytized and they avoid complement system.

They become thousands of times more resistant to antibiotics in this state.

This mechanism represents an prokaryote originated strategy and moreover under the right environmental conditions, the vast majority of microorganisms could exist inside a biofilm.

Uses Bioremediation Treatment Polluted water Illness Chemica waste





Strategies to fight biofilm



Anti quorum sensing

communication between neighboring microorganisms.

Unknown

Oils	organisms	Concentration	innibitioi
		15.62 $\mu g/mL$	-15%
Terminalia catappa	Chromo- bacterium violaceum	$62.5 \mu g/mL$	-50%
		1 mg/mL	-220%
		1 mg/mL + 1% SDS	48%

Opposite effects:

facilitate the generation

of biofilms

ompounds which

Table 1 – Opposite effect of Terminalia catappa

Traditional Medicine:

Compounds used worldwide which might have synergic properties, further study on this topic is required. Based on their natural source, they represent a based remedies.

		biofilm		
MT India	Melia dubia	Anti QS	Escherichia coli	84%
MT India	Cuminum cyminum	Anti QS	Chromobacterium violaceum	87%
MT Philippines	Terminalia catappa	Anti QS	Chromobacterium violaceum	50%
MT Brazil	Chamaecrista desvauxii	Antimicrobian	Staphylococcus epidermidis	87.40%
MT Brazil	Boesenbergia pandulata	Anti QS	Candida spp	98%
MT China	Panax notoginseng	Anti QS	Pseudomonas aeruginosa	50%
MT China	Areca catechu	Anti QS + Anti micro	Pseudomonas aeruginosa	79%
MT Euro-Asian	Achillea millefolium	Anti-metabolism	Listeria innocua	79.40%
MT Euro-Asian	Moringa oleifera	Anti QS + anti-oxidant	Chromobacterium violaceum	85.77%

Table 2 - Collection of research articles of worldwide traditional medicine

Future strategies: Mixed solutions represent a powerful

Essential biopolymers

Conclusions:

- On the long term, the available solutions are not efficient enough.
- Worldwide traditional medicine seems to have found some more efficient compounds on their own.
- Mixed compounds showed some evidence to have a higher efficiency on inhibiting the biofilm creation. The study of the synergy between mixing current solutions and traditional medicine holds they key of the future of biofilm fight.

anti-adherent