Le nettoyage probiotique

Dr. Robin Temmerman

Chrisal

Chrisal

Créée en 1989 en Belgique

Produits d'hygiène,
d'entretien et
de soins personnels

La pureté et le respect
de l'homme et
de la nature

Problématiques

Biofilm

Procédures de nettoyage ou des produits inefficients stimulent le biofilm sur les surfaces

Résistance

Le biofilm stimule la résistance des bactéries contre les antibiotiques et les biocides

Litérature:

Stewart and Costerton. Antibiotic resistance of bacteria in biofilms. Lancet 2001

Chrisal
CLEANING PRODUCTS

Les probiotiques sont des bonnes bactéries avec des effets bénéfiques pour l'homme et les animaux

Chrisal
CLEANING PRODUCTS

Le nettoyage probiotique

Les produits de nettoyage probiotiques sont des détergents. Ils ne sont pas des biocides!

European Commission. July 2016:

*Following discussions with DG GROW and industry, it has been established that the **Detergents Regulation** should be interpreted to mean that **microbial cleaning products** that have the combined action of traditional surfactants and bacteria **fulfil the definition of a detergent** as set out in the Detergents Regulation and fall, therefore, under its scope.*

Chrisal
CLEANING PRODUCTS

Le nettoyage probiotique

1. Nettoyage en profondeur microscopique
2. Effet et protection de longue durée
3. Contrôle actif des odeurs
4. Risque plus faible de germes et d'infections
5. Enlèvement du biofilm
6. Technologie 100% naturelle
7. Environnement bénéfique
8. Réduction des coûts

Chrisal
CLEANING PRODUCTS

Le nettoyage probiotique

Les ingrédients:

1. Détergents (produits chimiques)
   Immédiatement - jusqu'à 30 min d'activité

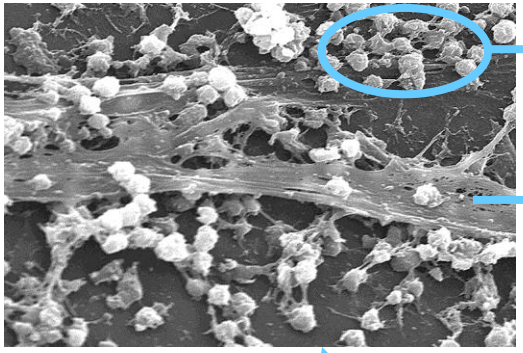
2. Enzymes (biochimiques)
   Après 10 minutes - jusqu'à 2 heures d'activité

3. Probiotiques (biologiques)
   Après 20 min - jusqu'à 3 jours d'activité

La combinaison de détergents, d'enzymes et de probiotiques entraîne une activité rapide et durable> **EFFICACITÉ !!!**

Chrisal
CLEANING PRODUCTS

Biofilm



Micro-organismes
(bactéries, champignons, archées, algues…)

Matrice liant les biofilms
(exopolysaccharides, protéines…)

Présence universelle sur les surfaces
Dans les machines, sur notre corps…

Très tenaces

Abri pour les mauvais germes

Source de mauvaises odeurs

Chrisal
CLEANING PRODUCTS

Nettoyage à l'échelle microscopique

Nettoyage chimique

Nettoyage probiotique

Chrisal
CLEANING PRODUCTS

Nettoyage à l'échelle microscopique

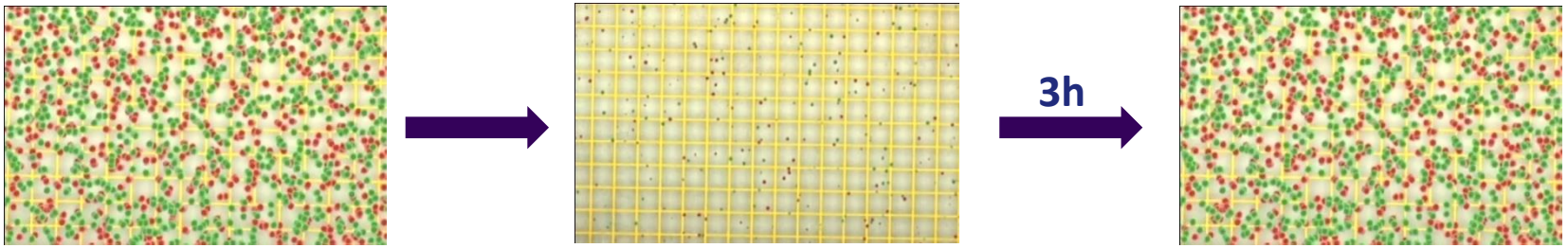
Nettoyage chimique

Nettoyage probiotique

Chrisal
CLEANING PRODUCTS

La micro-flore saine

Désinfection



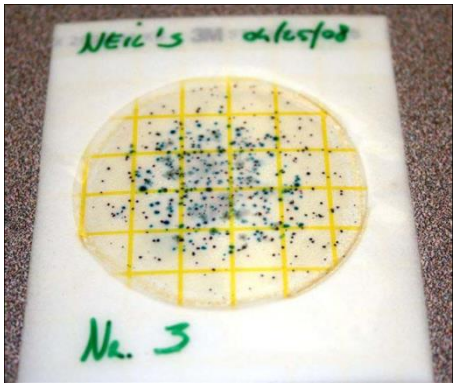
- **Bonnes bactéries**
- **Mauvais germes**

PIP®

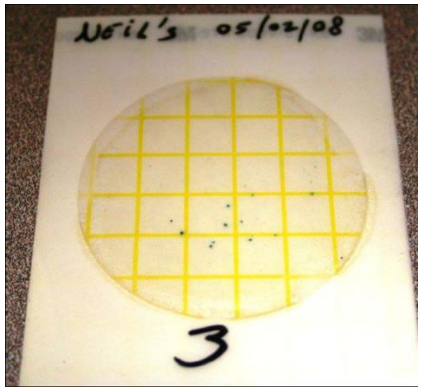
Stabilité!

Chrisal
CLEANING PRODUCTS

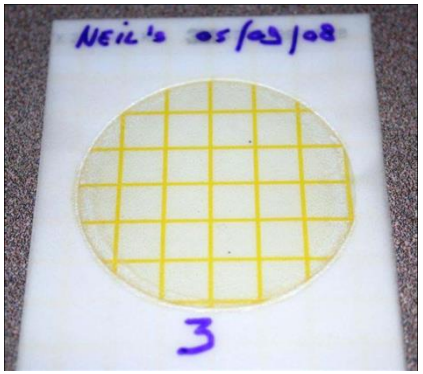
Micro-flore saine



Jour 0



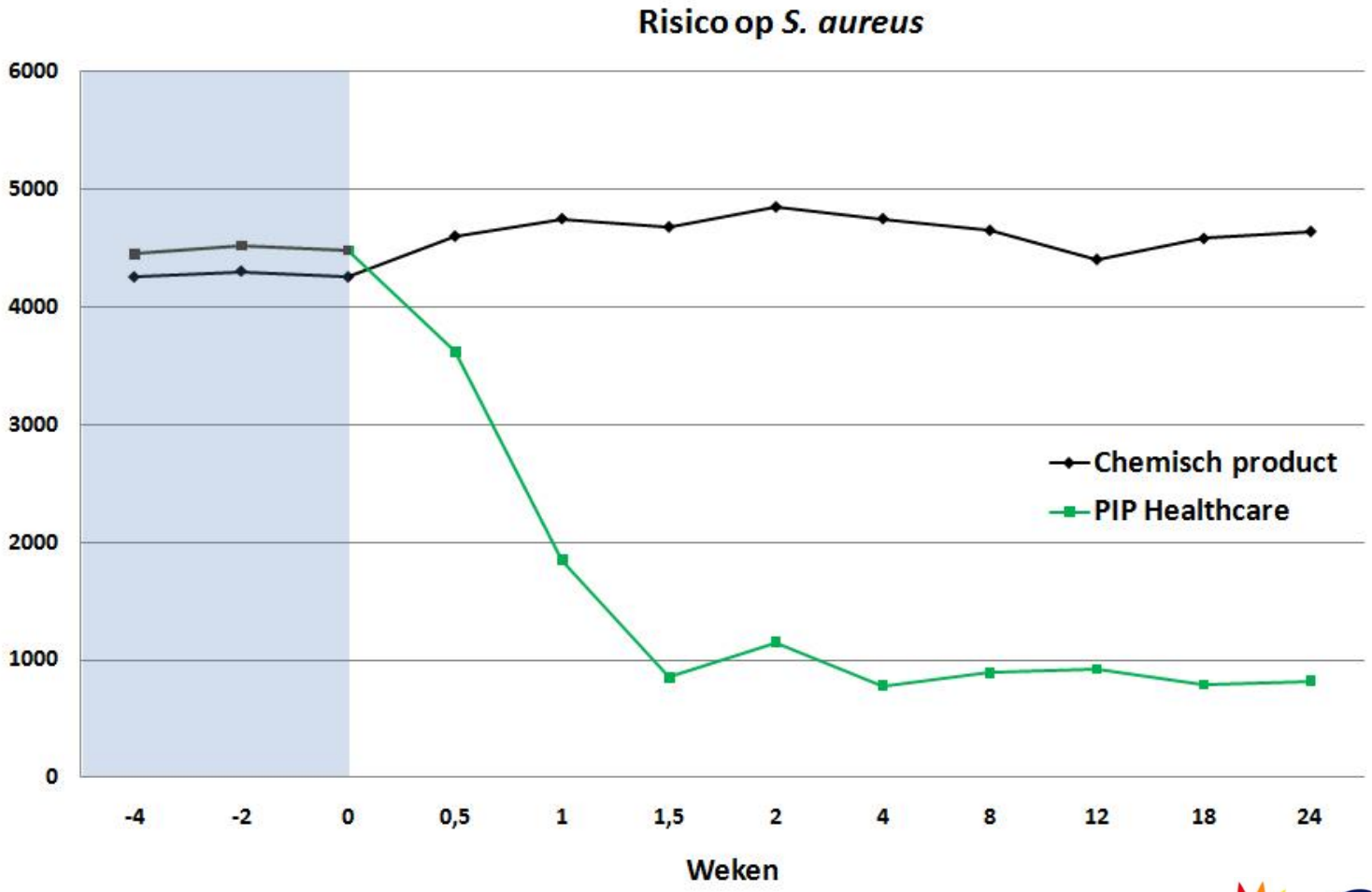
Jour 7



Jour 14

Chrisal
CLEANING PRODUCTS

Micro-flore saine



Chrisal
CLEANING PRODUCTS

OPEN ACCESS Freely available online

PLOS ONE

Hard Surface Biocontrol in Hospitals Using Microbial-Based Cleaning Products

Alberta Vandini[1], Robin Temmerman[2,3], Alessia Frabetti[1], Elisabetta Caselli[4], Paola Antonioli[5], Pier Giorgio Balboni[4], Daniela Platano[6], Alessio Branchini[7], Sante Mazzacane[1]*

1 CIAS Laboratory, Centre for the Study of physical, chemical and microbiological Contamination of Highly Sterile Environments, Department of Architecture, University of Ferrara, Ferrara, Italy, **2** Laboratory of Microbial Ecology and Technology, Ghent University, Ghent, Belgium, **3** Chrisal R & D Department, Lommel, Belgium, **4** Department of Medical Sciences, Microbiology Section, University of Ferrara, Ferrara, Italy, **5** Department of Infection Prevention Control and Risk Management, Ferrara University Hospital, Ferrara, Italy, **6** Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy, **7** Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, Italy

Abstract

Background: Healthcare-Associated Infections (HAIs) are one of the most frequent complications occurring in healthcare facilities. Contaminated environmental surfaces provide an important potential source for transmission of many healthcare-associated pathogens, thus indicating the need for new and sustainable strategies.

Aim: This study aims to evaluate the effect of a novel cleaning procedure based on the mechanism of biocontrol, on the presence and survival of several microorganisms responsible for HAIs (i.e. coliforms, *Staphyloccus aureus*, *Clostridium difficile*, and *Candida albicans*) on hard surfaces in a hospital setting.

Methods: The effect of microbial cleaning, containing spores of food grade *Bacillus subtilis*, *Bacillus pumilus* and *Bacillus megaterium*, in comparison with conventional cleaning protocols, was evaluated for 24 weeks in three independent hospitals (one in Belgium and two in Italy) and approximately 20000 microbial surface samples were collected.

Results: Microbial cleaning, as part of the daily cleaning protocol, resulted in a reduction of HAI-related pathogens by 50 to 89%. This effect was achieved after 3–4 weeks and the reduction in the pathogen load was stable over time. Moreover, by using microbial or conventional cleaning alternatively, we found that this effect was directly related to the new procedure, as indicated by the raise in CFU/m^2 when microbial cleaning was replaced by the conventional procedure. Although many questions remain regarding the actual mechanisms involved, this study demonstrates that microbial cleaning is a more effective and sustainable alternative to chemical cleaning and non-specific disinfection in healthcare facilities.

Conclusions: This study indicates microbial cleaning as an effective strategy in continuously lowering the number of HAI-related microorganisms on surfaces. The first indications on the actual level of HAIs in the trial hospitals monitored on a continuous basis are very promising, and may pave the way for a novel and cost-effective strategy to counteract or (bio)control healthcare-associated pathogens.

Citation: Vandini A, Temmerman R, Frabetti A, Caselli E, Antonioli P, et al. (2014) Hard Surface Biocontrol in Hospitals Using Microbial-Based Cleaning Products. PLoS ONE 9(9): e108598. doi:10.1371/journal.pone.0108598

Editor: Gabriele Berg, Graz University of Technology (TU Graz), Austria

Received May 25, 2014; **Accepted** August 23, 2014; **Published** September 26, 2014

Data Availability: The authors confirm that all data underlying the findings are fully available without restriction. All relevant data are within the paper and its Supporting Information files.

Funding: This research was financially supported by COPMA scrl, Chrisal NV and the Flemish Institute for the Promotion of Innovation by Science and Technology (IWT - Vlaanderen, Brussels, Belgium). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors declare that they received funding from the Copma scrl commercial company, and that Dr. Robin Temmerman is affiliated to a commercial funder of this study (Chrisal, Lommel, Belgium). This does not alter the authors' adherence to PLOS ONE policies on sharing data and materials.

* Email: sante.mazzacane@unife.it

Introduction

Healthcare-Associated Infections (HAIs) are one of the most frequent complications occurring in healthcare facilities and represent a problematic concern regarding the safety and quality of healthcare worldwide [1], as also stated in a recent report by the World Health Organization estimating hospital-wide prevalence in high-income countries at 8% [2]. The European Center for Disease Control point prevalence study confirmed that healthcare-associated infections are a major public health problem in Europe with a prevalence of 5.7% (4.5–7.4%) which means 81.089 (64.624–105.895) patients with one HAI for each day in European acute care hospitals [3]. In particular, this European survey reported a similar estimation of nosocomial infections for Italy and Belgium, where the percentage of patients with HAIs has been calculated as 6.3% (5.4–7.4%) and 7.1% (6.1–8.3%), respectively [1]. Based on this study, the estimated total annual number of patients with an HAI in European acute care hospitals in 2011–2012 was 3.2 million, albeit with a wide confidence interval from

Vandini et al. 2014

"This study demonstrates that microbial (probiotic-based) cleaning is more effective in the long-term lowering of the number of HAI-related microorganisms on surfaces, when compared to conventional cleaning products, even those containing disinfectant molecules such as chlorine."

PLOS | ONE

Caselli et al. 2016a

RESEARCH ARTICLE

Impact of a Probiotic-Based Cleaning Intervention on the Microbiota Ecosystem of the Hospital Surfaces: Focus on the Resistome Remodulation

Elisabetta Caselli[1,2]*, Maria D'Accolti[1,2], Alberta Vandini[2,5], Luca Lanzoni[2], Maria Teresa Camerada[2,5], Maddalena Coccagna[2], Alessio Branchini[3], Paola Antonioli[4], Pier Giorgio Balboni[2], Dario Di Luca[1,2], Sante Mazzacane[2]

1 Section of Microbiology and Medical Genetics, Department of Medical Sciences, University of Ferrara, Ferrara, Italy, **2** CIAS Interdepartmental Research Center for pollution control in high sterility rooms, University of Ferrara, Ferrara, Italy, **3** Section of Biochemistry and Molecular Biology, Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, Italy, **4** Department of Infection Prevention Control and Risk Management, S. Anna University Hospital, Ferrara, Italy, **5** Architecture and Urban Planning (XXX cycle), Department of Architecture, University of Ferrara, Ferrara, Italy

* elisabetta.caselli@unife.it

OPEN ACCESS

Citation: Caselli E, D'Accolti M, Vandini A, Lanzoni L, Camerada MT, Coccagna M, et al. (2016) Impact of a Probiotic-Based Cleaning Intervention on the Microbiota Ecosystem of the Hospital Surfaces: Focus on the Resistome Remodulation. PLoS ONE 11(2): e0148857. doi:10.1371/journal.pone.0148857

Editor: Yung-Fu Chang, Cornell University, UNITED STATES

Received: December 4, 2015

Accepted: January 25, 2016

Published: February 17, 2016

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Funding: This study was financially supported by COPMA scrl (Ferrara, Italy). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors declare that they have received funding by the commercial company Copma scrl. This does not alter the authors' adherence to PLOS ONE policies on sharing data and materials.

Abstract

Background

Contamination of hospital surfaces by clinically-relevant pathogens represents a major concern in healthcare facilities, due to its impact on transmission of healthcare-associated infections (HAIs) and to the growing drug resistance of HAI-associated pathogens. Routinely used chemical disinfectants show limitations in controlling pathogen contamination, due to their inefficacy in preventing recontamination and selection of resistant strains. Recently we observed that an innovative approach, based on a cleanser added with spores of non-pathogenic probiotic *Bacilli*, was effective in stably counteracting the growth of several pathogens contaminating hospital surfaces.

Methods

Here, we wanted to study the impact of the *Bacillus*-based cleanser on the drug-resistance features of the healthcare pathogens population. In parallel, the ability of cleanser-derived *Bacilli* to infect hospitalized patients was also investigated.

Results

Collected data showed that *Bacilli* spores can germinate on dry inanimate surfaces, generating the bacterial vegetative forms which counteract the growth of pathogens and effectively substitute for them on treated surfaces. Strikingly, this procedure did not select resistant species, but conversely induced an evident decrease of antibiotic resistance genes in the contaminating microbial population. Also importantly, all the six HAI-positive

"Probiotic Bacillus strains, best known for their usefulness as food supplements or fungicides, can be also successfully exploited in sanification procedures, as they counteract the growth of pathogens and, most importantly, they decrease drug resistance genes of pathogens, which is a global concern and which is ultimately responsible for the onset of the most severe HAIs."

Chrisal
CLEANING PRODUCTS

Journal of Hospital Infection 94 (2016) 193–208

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Letters to the Editor

Safety of probiotics used for hospital environmental sanitation

Sir,

There is consensus about the need for efficient control of microbial contamination on hospital surfaces, as these surfaces represent significant pathogen reservoirs that may contribute to transmission of healthcare-associated infections (HCAIs). The emergence of multidrug-resistant pathogens in hospitals is a global concern.[1]

Control of surface bioburden is routinely addressed by use of conventional chemical-based detergents/disinfectants; however, these are ineffective in preventing recontamination, and may select resistant strains. Recently, cleaning agents containing probiotics of the genus *Bacillus* have been proposed for hospital sanitation [Probiotic Cleaning Hygiene System (PCHS); Copma srl, Ferrara, Italy]; these have been shown to stably decrease surface pathogens up to 90% more than conventional disinfectants, and to be genetically stable even after years of continuous contact with surface pathogens.[2,3] The rationale for the use of probiotics as sanitizing agents lies in the idea that a healthy microbiota might protect against colonization by, and expansion of, pathogens in the environment as well as in the human body; this has been called 'bidirectional' hygiene.[4]

The three species contained in the probiotic cleansers (*Bacillus subtilis*, *Bacillus pumilus*, and *Bacillus megaterium*) are considered non-pathogenic for humans.[5] Nevertheless, a theoretical risk of infection exists, and a few anecdotal cases of infection by *B. subtilis* have been reported in surgical patients.[5] However, systematic assessment of adverse events in probiotic intervention studies is lacking, whereas it has recently been proposed that the most appropriate way to investigate whether probiotics are safe is to use the 'totality of evidence' rather than single case reports.[6,7] Active surveillance for cases of probiotic-associated infection in all probiotic-based trials has been advocated.[8] Thus, we have analysed whether the *Bacillus* spp. included in cleaning products may themselves be a source of HCAIs. We investigated whether any infections with *Bacillus* spp. occurred in seven healthcare institutions in the province of Ferrara (Italy) that used the PCHS throughout.

In addition to routine culture of all 32,139 clinical samples from around 90,000 patients and 800,000 hospitalization days, a quota of samples was also analysed by a *Bacillus*-specific real-time quantitative polymerase chain reaction, as previously described.[2] The numbers of analysed samples from each institution, as well as the period of environmental sanitation by PCHS, are shown in Table I. Both culture-based and molecular testing showed complete absence of PCHS-derived bacilli in any clinical sample, for the entire period of the survey. This suggests that probiotic *Bacillus* spp. do not cause infections, even in the subjects at high risk of opportunistic infections.

We think that this surveillance model represents an essential part of the infection control policy associated with the use of probiotics, as it provides ongoing assurance of safety. Accordingly, we are now undertaking a multi-centre study to evaluate a larger number of healthcare institutions for a prolonged period.

Table I
Analyses performed in the years 2011–2015 in the healthcare structures (HS) continuously using the *Bacillus*-based Probiotic Cleaning Hygiene System (PCHS)

Healthcare structures	Analyses per year (with PCHS sanitation system)					Total analyses (per HS)
	2011	2012	2013	2014	2015	
HS-1	429	–	–	–	–	429
HS-2	103	704	701	613	765	2886
HS-3	–	–	6346	7290	7593	21,229
HS-4	–	76	1025	969	1154	3224
HS-5	–	72	631	713	750	2166
HS-6	–	240	403	498	554	1695
HS-7	–	–	–	–	510	510[a]
Total[b]	532	1092	9106	10,083	11,326	32,139

HS-1, Old S. Anna Hospital (Ferrara), PCHS application March 16th to August 28th, 2011; HS-2, S. Giorgio Hospital (Ferrara), PCHS application since November 1st, 2011; HS-3, New S. Anna Hospital (Cona, Ferrara), PCHS application since January 1st, 2013; HS-4, Delta Hospital (Lagosanto, Ferrara), PCHS application since June 1st, 2012; HS-5, Cento Hospital (Cento, Ferrara), PCHS application since July 1st, 2012; HS-6, Argenta Hospital (Argenta, Ferrara), PCHS application since July 1st, 2012; HS-7, Quisisana Hospital (Ferrara), PCHS application since January 1st, 2015.

[a] A quota of these samples was simultaneously analysed also by molecular assays (qPCR).

[b] A unique central Microbiology Laboratory (S. Anna University Hospital, Ferrara) performed the analyses by conventional microbiological assays.

Caselli et al. 2016b

"This suggests that probiotic Bacillus spp. do not cause infections, even in the subjects at high risk of opportunistic infections."

This means that the probiotic Chrisal products can be safely used in the presence of pregnant women, children, elderly or immuno compromised people.

Chrisal
CLEANING PRODUCTS

CONCLUSION GÉNÉRALE

La nettoyage probiotique a pour conséquences:

- **Un nettoyage en profondeur**
- **La suppression du biofilm**
- **La réduction des odeurs et des gaz**
- **Un risque réduit de mauvais germers dans l'environnement**
- **Une meilleure higiène et un meilleur état de santé**
- **Un impact positif et automatique sur les eaux usées**

Chrisal
CLEANING PRODUCTS

PARCE QUE CELA NOUS TIENT À COEUR…

Chrisal