

Materials Compatibility - what does it mean to IPC?

Jake Jennings – ACIPC Conference 2023

Home > Alerts, recalls and safety information: drugs and medical devices

Detergent and disinfectant wipes used on reusable medical devices with plastic surfaces – risk of degrading plastic surfaces

(All manufacturers) Ensure detergent and disinfectant wipes are compatible with the device. (MDA/2013/019)

GOV.UK (2014, accessed September 2022).

Surface Disinfection Incompatibility Does Not Support Effective Cleaning and Disinfection

May 1, 2022

By Sharon Ward-Fore, MS, MT(ASCP), CIC, FAPIC, Linda Lybert

Infection Control Today, Volume 26, Issue 4



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The surface material and product damage caused by new advances in disinfection technology must be addressed for patient safety.

INFECTIONCONTROLTODAY.COM (2022, accessed September 2022).



About Resources Certification

FDA recalls medical devices damaged by incompatible disinfectants

by Healthcare Surfaces Institute | Apr 27, 2022 | Cleaning & Disinfection |

HEALTHCARESURFACESINSTITUTE.ORG (2022, accessed September 2022).

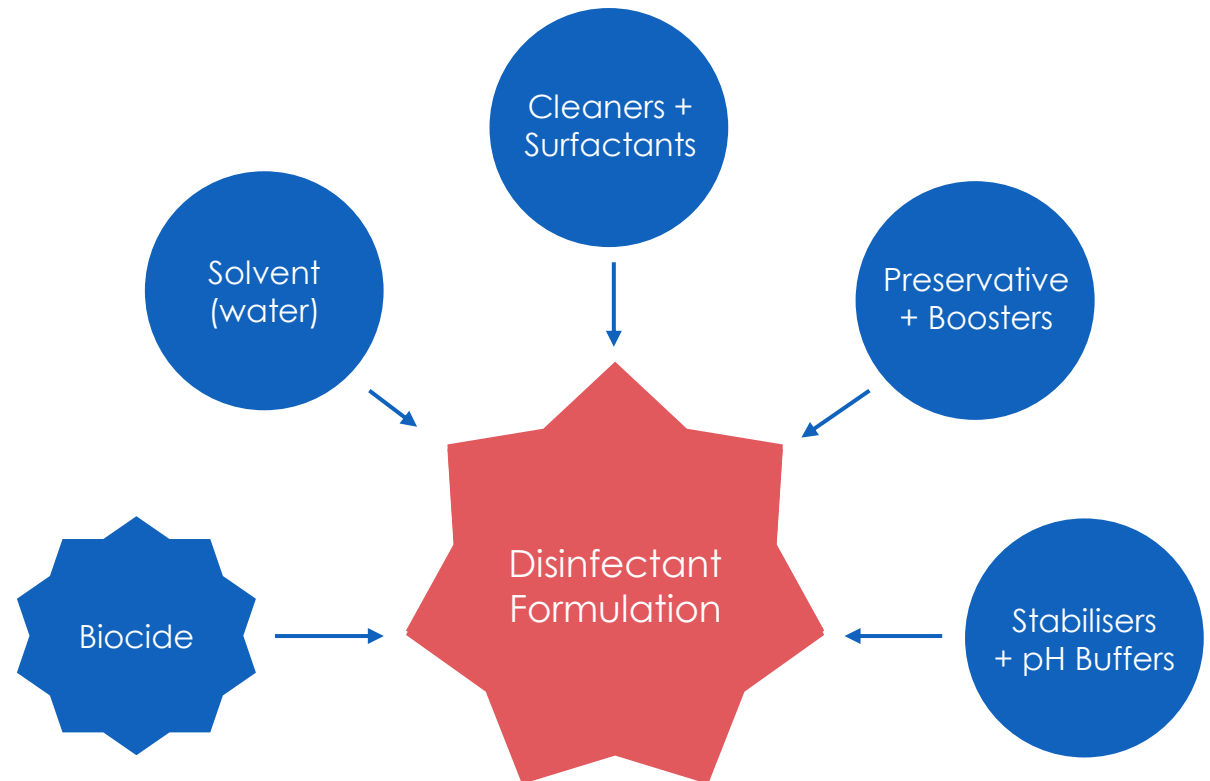
Device Failures
Caused by
Cleaning Products
and Practices



ECRI.ORG (2017, accessed September 2022).

DISINFECTANTS AND DETERGENTS

- Disinfectants and detergents come in a variety of forms:
 - Liquids applied with a dry cloth or mop as pre-mixed solutions, tablets, granules, sprays.
 - Ready-to-use wipes.
- Disinfectant products are often not an individual biocide, but a formulation designed to (ideally) deliver a safe and efficacious product as per its intended use.



DISINFECTION IN CLINICAL PRACTICE

Typical hospital room – high touch surfaces



Non-invasive shared patient care equipment



MATERIALS FOUND IN SURFACES

Metals

Stainless steel (different grades)

Titanium

Brass

Copper

Aluminium

Iron

Thermoplastics

Polypropylene

Polyethylene

Polycarbonate

PMMA (Perspex)

ABS

Polystyrene

Polyvinyl chloride

POM (Acetal)

Polyphenylene oxide

Polysulfone

Other

Wood

Vinyls

Laminates

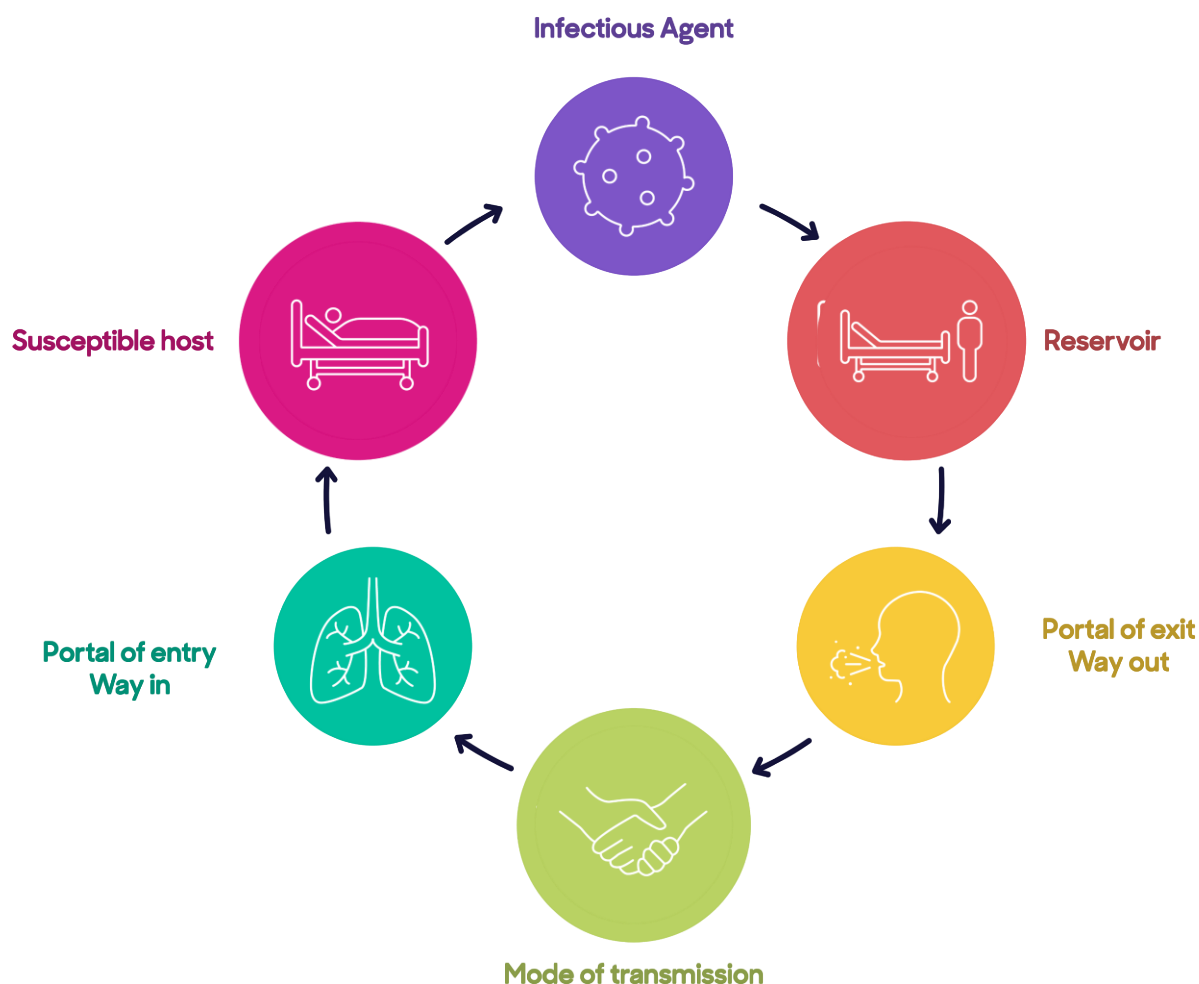
Leathers

Rubbers

Marble

DISINFECTION IN CLINICAL PRACTICE

Disinfection is helping **break the chain of transmission.**



Highly efficacious product BUT

- Damages the surface – can still be used
 - **but creates a reservoir for microbes**
 - facilitates transmission of HAIs
 - risk to patient/staff.



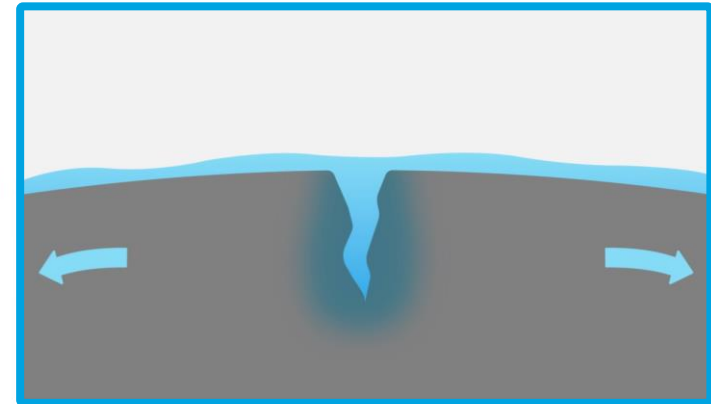
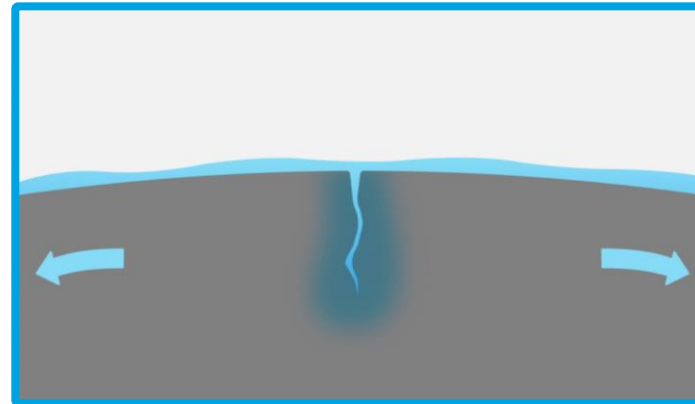
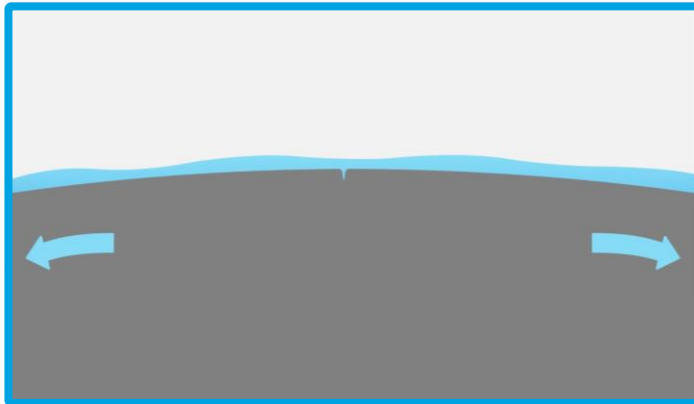
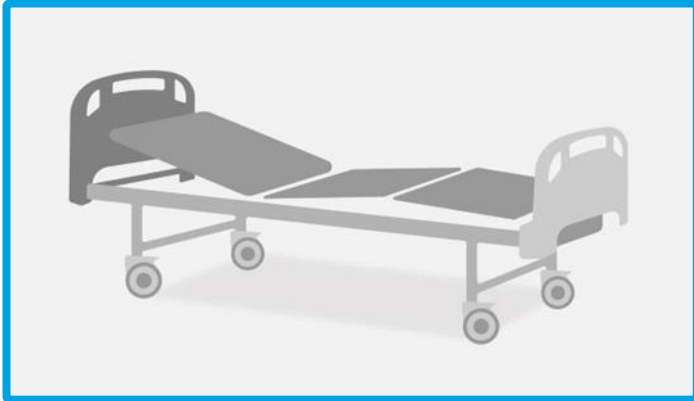
- **Damages the surface so its no longer safe to use**
 - risk to patient/staff
 - cost of replacement.
- **Destroys the surface so it fails**
 - can't be used
 - cost of replacement.

SOME DEFINITIONS

- **Material Compatibility** - A materials resistance to damage when exposed to a chemical, in this case a disinfectant or detergent formulation.
- **Environmental Stress Cracking (ESC)** is premature cracking of a plastic due to the combination of:
 1. Strain – deformation on a molecular level due to stress on the plastic.
 2. ESC agents – molecules that come into contact with the plastic and can cause cracking.



ENVIRONMENTAL STRESS CRACKING – MECHANISM

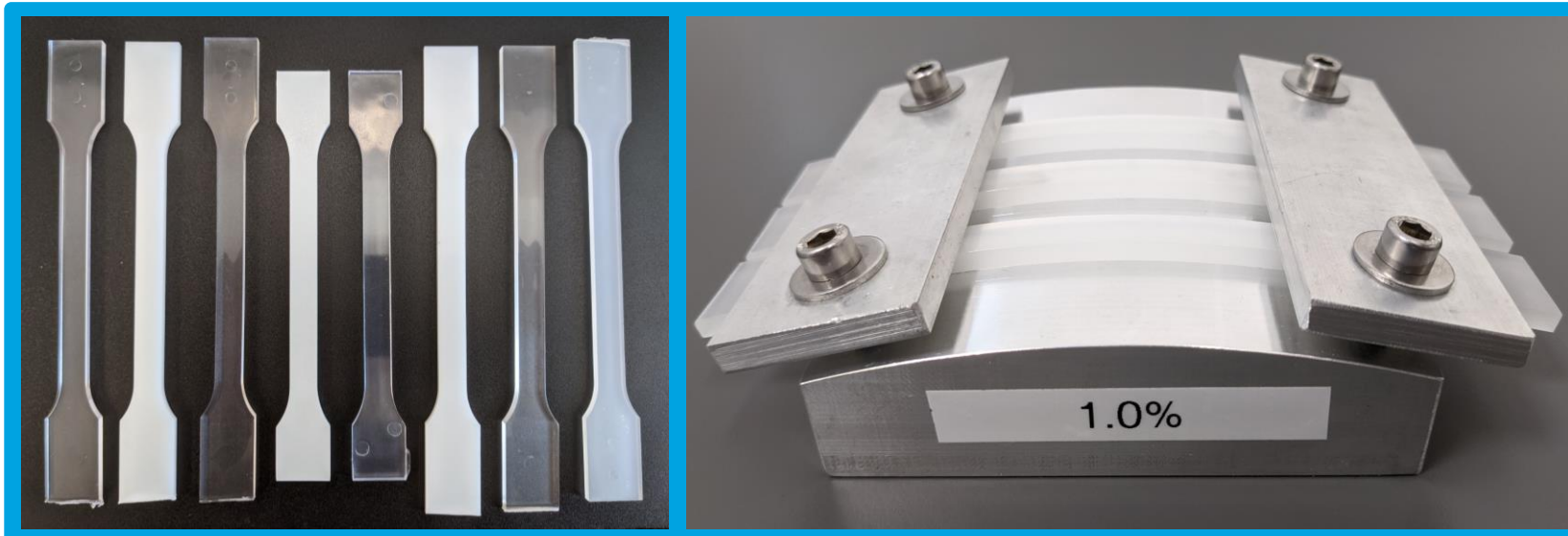


COMPATIBILITY ISSUES



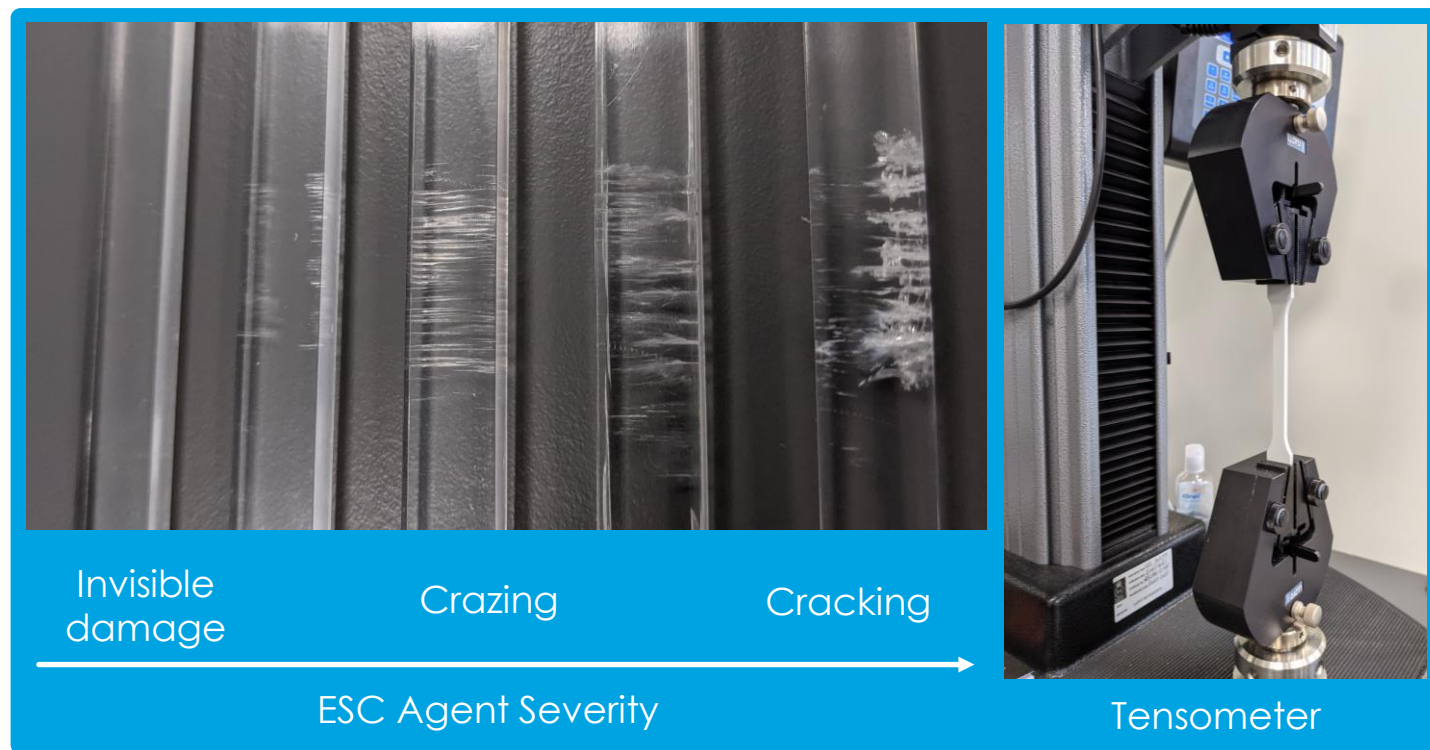
TESTING FOR ENVIRONMENTAL STRESS CRACKING

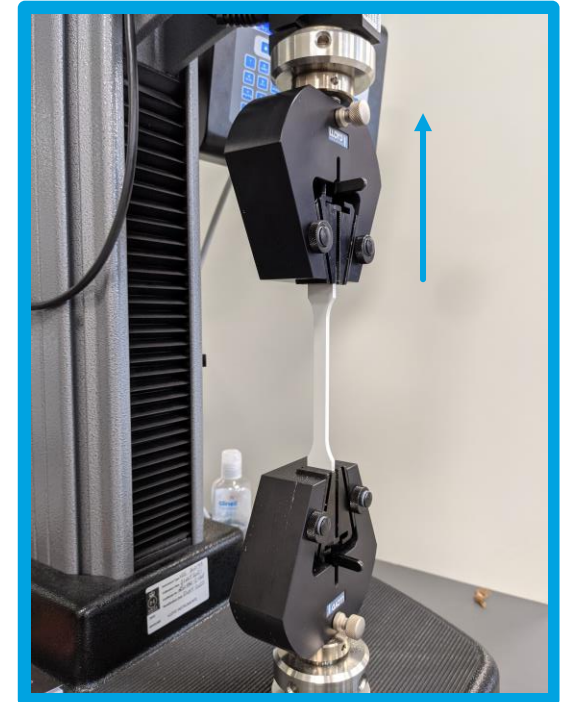
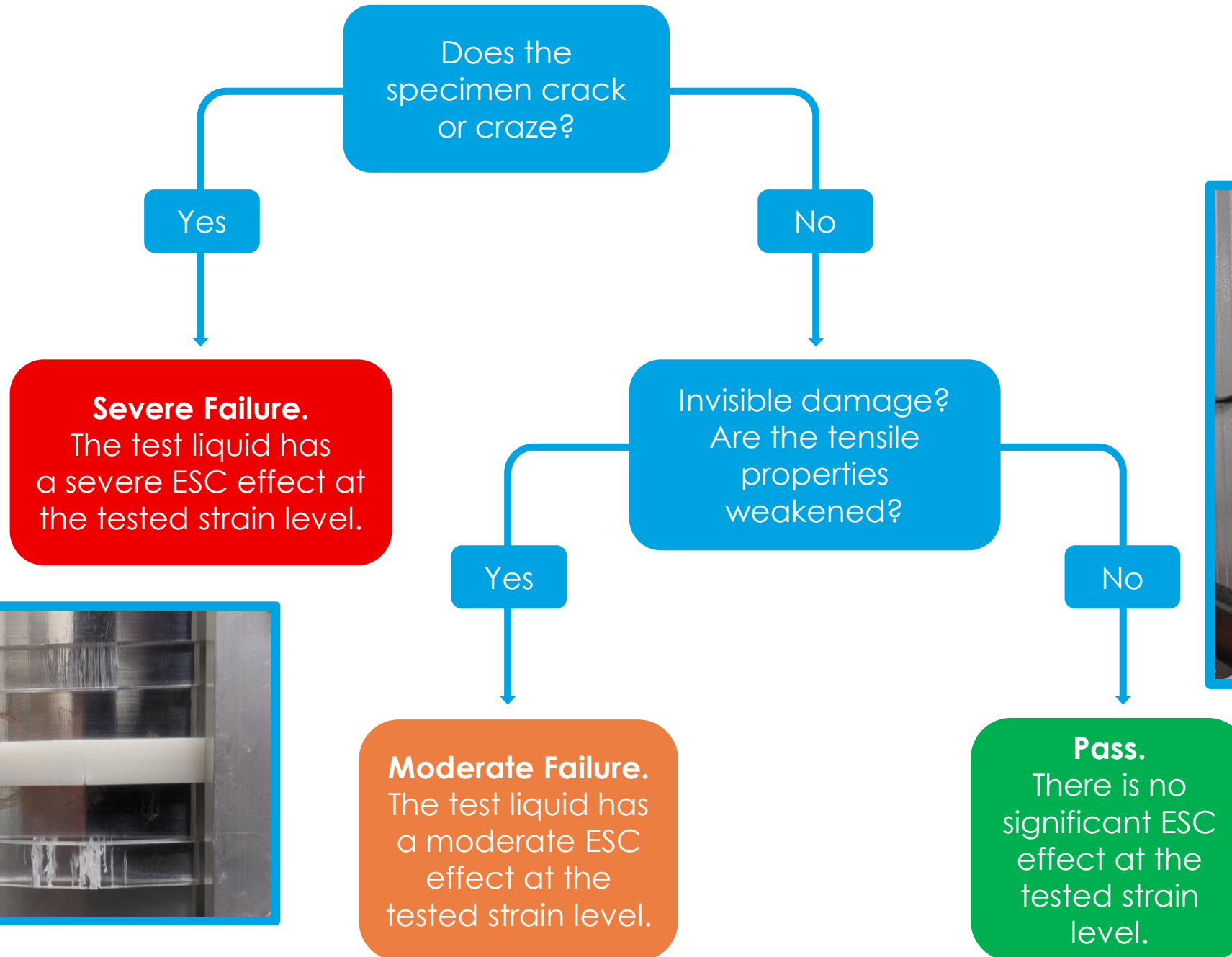
- Testing is to standards [ISO 22088:2016 part 3](#) or [ASTM D543 Practice B](#).
- Both standards require applying a **constant strain to a thermoplastic**.
- Once the test specimen is under strain it needs to be exposed to a test fluid – [disinfectant or detergent formulation](#).
- Looking for [cracking](#) of specimens within the exposure period – this can differ but usually 7 days!



TESTING FOR ENVIRONMENTAL STRESS CRACKING

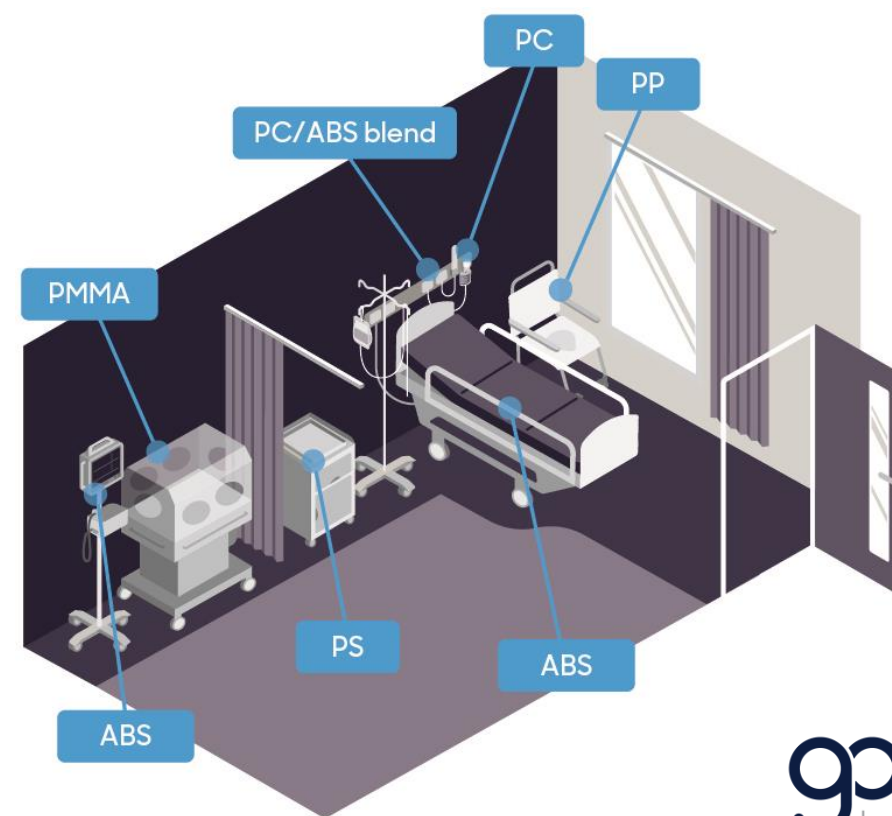
- During and after the exposure period we check for **crazing and cracking**.
- Environmental stress cracking goes through stages of crazing to cracking depending on the **severity of the ESC agent**.
- Sometimes the ESC effect can be small and there can be invisible damage.
- To test for **invisible damage**, we can test the tensile properties, the force required to pull the plastic until it breaks.





ESC TESTING OF COMMERCIAL PRODUCTS

- Five commercially available disinfectant and cleaning pre-wetted wipe products [used in Australian hospitals and the UK NHS](#) were tested for ESC on seven different polymer grades.
- Six amorphous polymers prone to ESC and one semi-crystalline, all found in clinical settings:
 - [Polycarbonate \(PC\)](#) – surgical instruments, infusion systems, blood delivery systems, hemodialysers, handles and transparent sheets.
 - [ABS](#) – valves, drug delivery systems, portable device housing and casing.
 - [Polycarbonate/ABS blend](#) – equipment housing, monitoring devices, diagnostic equipment.
 - [PMMA \(Perspex\)](#) – incubators and screens.
 - [Polypropylene \(PP\)](#) – instrument connectors, containers and surgical trays.
- Tested at [0.5% strain](#) for 7 days at 23°C/50% RH using wet patch method.



0.5% Strain	Product 1	Product 2	Product 3	Product 4	Product 5
Polycarbonate (Medium Viscosity)	PASS	PASS	FAIL – Cracking from 120 hours	FAIL – Cracking from 36 hours	FAIL – Cracking from 12 hours
Polycarbonate (High Viscosity)	PASS	PASS	FAIL	FAIL – Cracking from 36 hours	FAIL – Cracking from 36 hours
Polycarbonate (w/ 10% Glass Fibres)	PASS	PASS	PASS	FAIL – Cracking from 120 hours	FAIL – Cracking from 120 hours
Acrylonitrile Butadiene Styrene (ABS)	PASS	PASS	PASS	PASS	PASS
Polycarbonate/ABS Blend	PASS	PASS	FAIL	PASS	FAIL – Cracking from 48 hours
Polymethyl Methacrylate (PMMA)	FAIL	FAIL – Cracking <i>immediately</i>	FAIL – Cracking from 72 hours	PASS	FAIL – Cracking from 120 hours
Polypropylene (PP)	PASS	PASS	PASS	PASS	PASS

COMPATIBILITY CHECK LIST



Disinfection Product

What ingredients are in this product?

What pH is this product?

What is the application of this product?

Is it CE-marked?



Surface or Device

What am I disinfecting?

What material(s) are present?

Does this device have a cleaning protocol?



Has the product been tested to a standard method ASTM/ISO?

Has the disinfection product been tested against the surface or device I want to use it on?

How does this impact the IPC policy/guidelines?

**Don't forget about efficacy!
But do consider material compatibility!**

Acknowledgements



Courtney Gray
Creative Designer



Karen Wares
Clinical Director



Harsha Siani
Scientific Affairs Director

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