Your inhouse Laundry Partner

Microfibre Condition Investigation Following Healthcare Laundry Processes

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1. INTRODUCTION

The use of microfibre technology within a healthcare environment has been well documented in providing an improvement in hygiene standards. However without the provision of good laundry facilities the system is of no value. Current hospital guidelines utilise wet heat as a method of disinfection, which does not always provide sufficient disinfection particularly in terms of spore forming bacteria, such as Clostridium difficile. In addition thermal disinfection is also totally reliant on the operator to select the correct program and the washer to maintain the specified temperature for the given contact time.

An alternative laundry method has been introduced and established utilising the second strongest bactericide known to man, ozone. This system, OTEX, developed by JLA has been introduced into a wide range of healthcare establishments, with the approval from several NHS Infection Control teams.

Due to the financial commitment in employing microfibres confirmation of the effect of ozone on the microfibres was requested. This report documents the work carried out investigating the condition of microfibre exposed to disinfection processes involving temperature and ozone under both laboratory and site conditions. The objective of this study was to establish whether ozone caused any detrimental effect on the condition and integrity of the fibres affecting their performance in comparison to traditional thermal disinfection techniques.

2. METHODOLOGY

Microfibres are generally a blend of polyester and polyamide, which have undergone a process splitting the yarn into thousands of tiny fibres. This creates a structure with a vast surface area capable of working effectively in both wet and dry conditions. Laboratory tests have been carried out to include samples, which had undergone 100 washes under laboratory conditions with additional site samples obtained, which had been processed with up to 250 OTEX washes and 500 thermal wash cycles. This allowed an assessment into the condition of the microfibre cloths under both thermal and ozone disinfection wash processes.

Tests conducted concentrated on the following:

- Measuring the effect on colour from the process
- Absorbency
- Loss in surface area ie shrinkage.
- Electron microscope imaging on the materials by an independent laboratory, to provide photographic evidence on the condition of the materials. As a forensic laboratory this work was also accompanied by impartial expert opinion on the fibre samples.

3. **TEST RESULTS.**

TABLE 1: Colour Loss

% Loss in Colour Laboratory Controlled Samples						% Colour Loss Site Specific Samples			
Wash Process	**20 Washes**	**40 Washes**	**60 Washes**	**80 Washes**	**100 Washes**	**Site**	**Process**	**Estimated Number of Wash Cycles**	**% Loss in Colour**
OTEX No tumble drying *010.680*	35	42	47	49	50	**Hospital A (QEII) *010.674***	OTEX With Tumble Dry 140F	250	26
OTEX with tumble drying at 180F *010.680*	43	50	50	55	66	**Hospital B (Rochdale) *015.026***	Thermal Disinfection With Tumble Dry 180F	90	13
Thermal Disinfection with tumble drying at 180F *010.680*	1	3	4	4	4	**Hospital C (CRH) *010.362***		Approaching 500	32

Microfibre Batch Number Given In Italics

TABLE 2: % Loss in Surface Area (Shrinkage)

% Loss in Surface Area Laboratory Controlled Samples						% Loss in Surface Area Site Specific Samples			
Wash Process	20 Washes	40 Washes	60 Washes	80 Washes	100 Washes	**Site**	**Process**	**Estimated Number of Wash Cycles**	**% Loss in Surface Area**
OTEX No tumble drying *010.680*	4.6	4.6	6.1	2.5	2.5	Hospital A (QEII) *010.674*	OTEX With Tumble Dry 140F	250	5
OTEX with tumble drying at 180F *010.680*	9.1	13.8	9.1	10	9.6	Hospital B (Rochdale) *015.026*	Thermal Disinfection With Tumble Dry 180F	90	12
Thermal Disinfection with tumble drying at 180F *010.680*	12.9	15	16	20	23	Hospital C (CRH) *010.362*		Approaching 500	32

Microfibre Batch Number Given In Italics

TABLE 3: % LOSS IN ABSORBENCY

% Loss in Absorbency Laboratory Controlled Samples						% Loss in Absorbency Site Specific Samples			
Wash Process	**20 Washes**	**40 Washes**	**60 Washes**	**80 Washes**	**100 Washes**	**Site**	**Process**	**Estimated Number of Wash Cycles**	**% Loss in Absorbency**
OTEX No tumble drying *010.680*	No measurable reduction in absorbency from new					Hospital A (QEII) *010.674*	OTEX With Tumble Dry 140F	250	No measurable reduction in absorbency from new
OTEX with tumble drying at 180F *010.680*						Hospital B (Rochdale) *015.026*	Thermal Disinfection With Tumble Dry 180F	90	37
Thermal Disinfection with tumble drying at 180F *010.680*	20	20	30		40	Hospital C (CRH) *010.362*		Approaching 500	50

Microfibre Batch Number Given In Italics

4. INDEPENDENT SCIENTIFICS RESULTS

Independent reports (Appendix B) on the condition of microfibres were commissioned. Samples were sent to Scientifics Ltd, Derby forensic section unidentified with the process to provide an unbiased opinion of their condition. The reports conclude that no evidence of chemical attack from ozone was found.

5. CONCLUSION & RECOMMENDATIONS

The results of the laboratory tests together with the independent reports and electron microscope images provide documentary evidence that OTEX, ozone disinfection laundry system does not have any detrimental effect on the microfibre integrity. In comparison there is evidence to suggest that damage does occur with current laundry practices. Thermal disinfection and tumble-drying at high temperatures as recommended by the HSG guidelines and in accordance with manufacturers care labels.

Whilst it is clear that there is a significant effect on colour from both traditonal and OTEX wash cycles, the manufacturer does claim that a loss in colour does not affect the performance of the cloths[1]. The loss in colour under laboratory conditions is more pronounced due to the absence of any soil, bacteria or detergent in the laboratory controlled tests. Standardisation of the ozone process together with the use of colour care detergents, also recommended by the manufacturer[1] could further minimise the loss in colour and should be investigated further.

Microfibre laundering via OTEX has been carried out at several sites including nursing homes and hospital with no adverse reports on their performance. Indeed BUPA which has currently 12 OTEX trial sites have been processing microfibre for over three years with ozone.

To summarise the combination of a controlled method of cleaning hard surfaces as provided by the microfibre, together with full training support by the suppliers can only be enhanced and validated by the laundering in the most efficient disinfection process available employing ozone, OTEX.

6. REFERENCES

1. Recommendations from ACT® for washing cycle. Actex®, source and date unknown.

APPENDIX A: GRAPHICAL REPRESENTATION OF RESULTS

Table 1: Loss in Colour Laboratory Controlled Samples

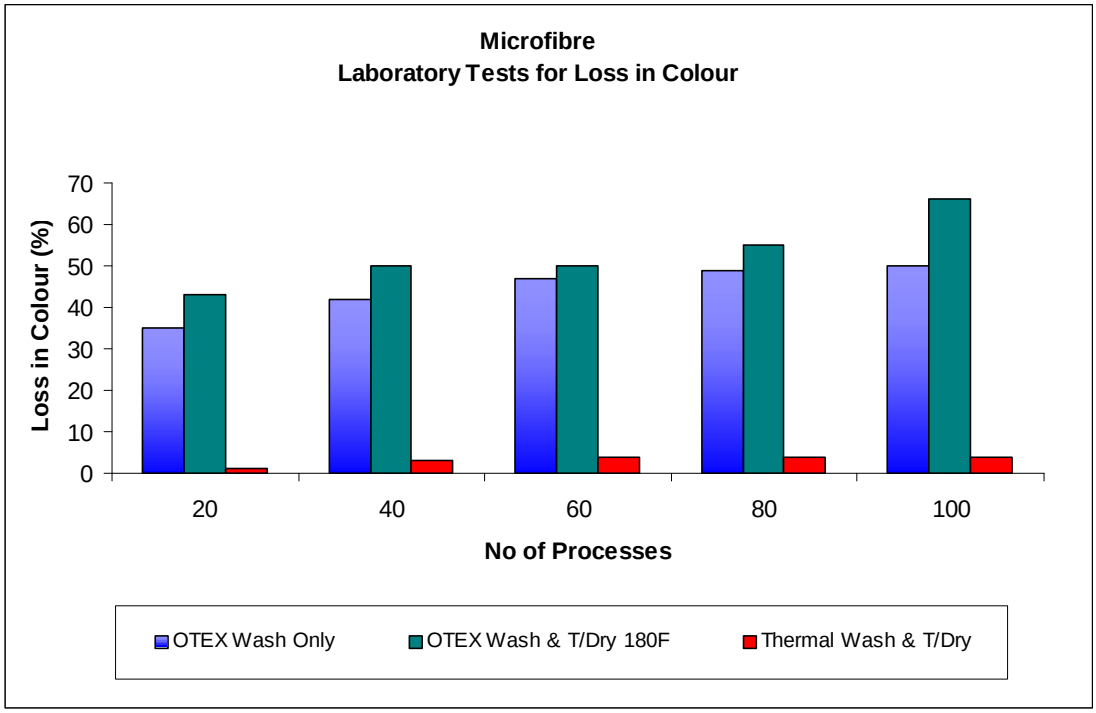


Table 2: Loss in Colour Site Samples

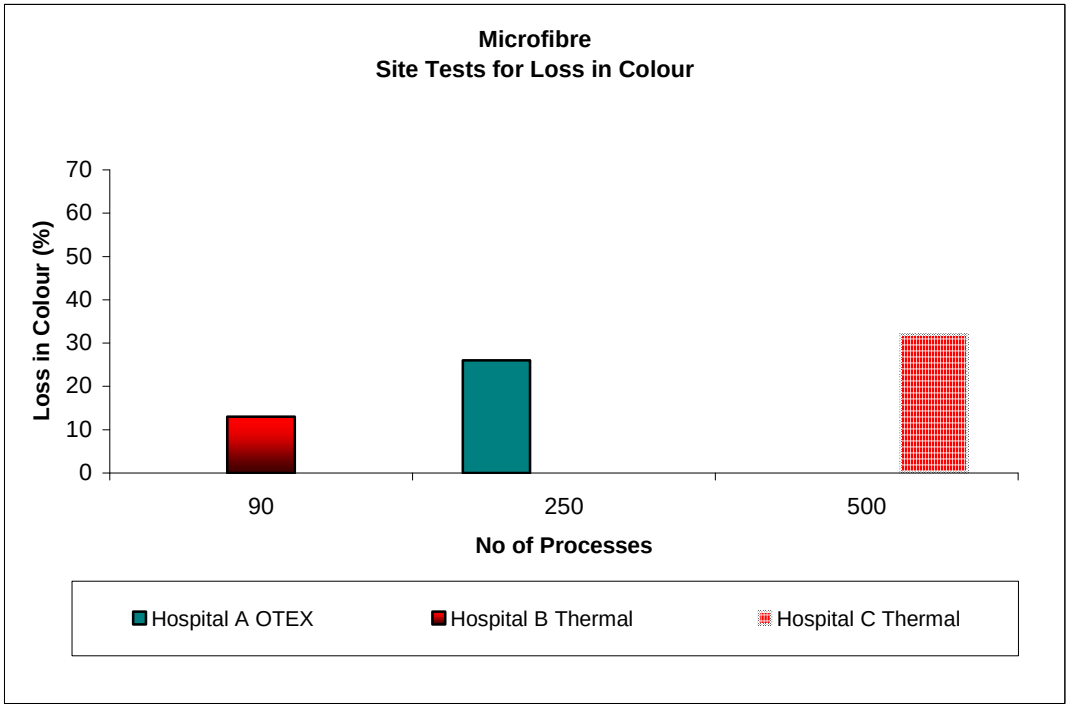


Table 3: Loss in Surface Area Laboratory Controlled Samples

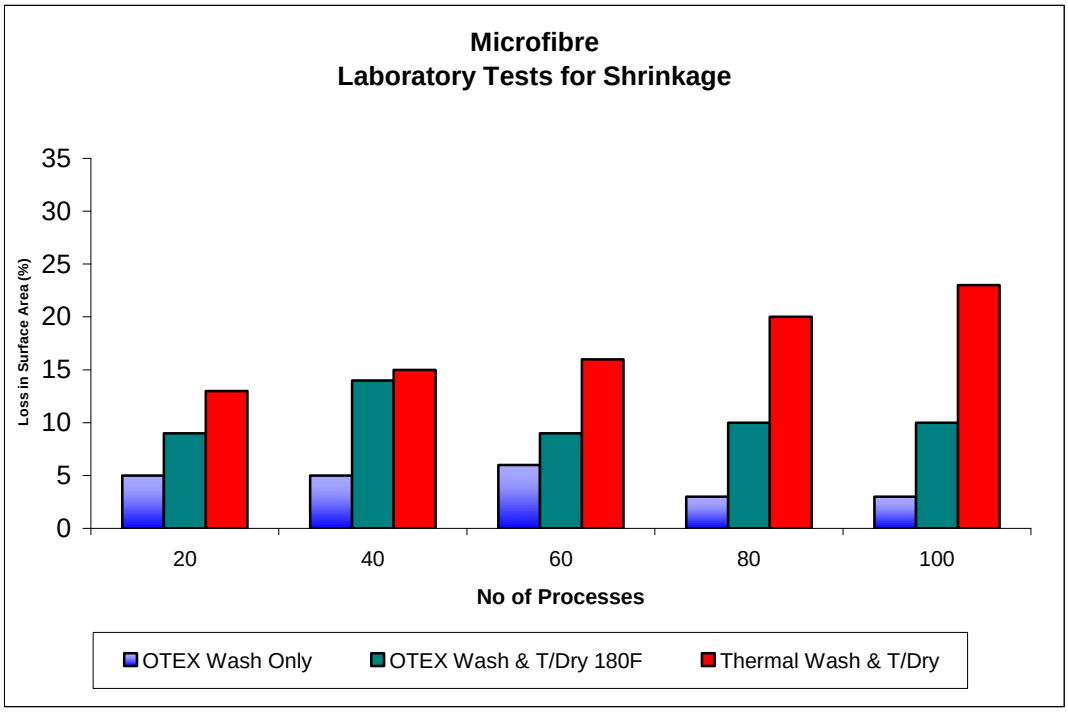


Table 4: Loss in Surface Area Site Sample

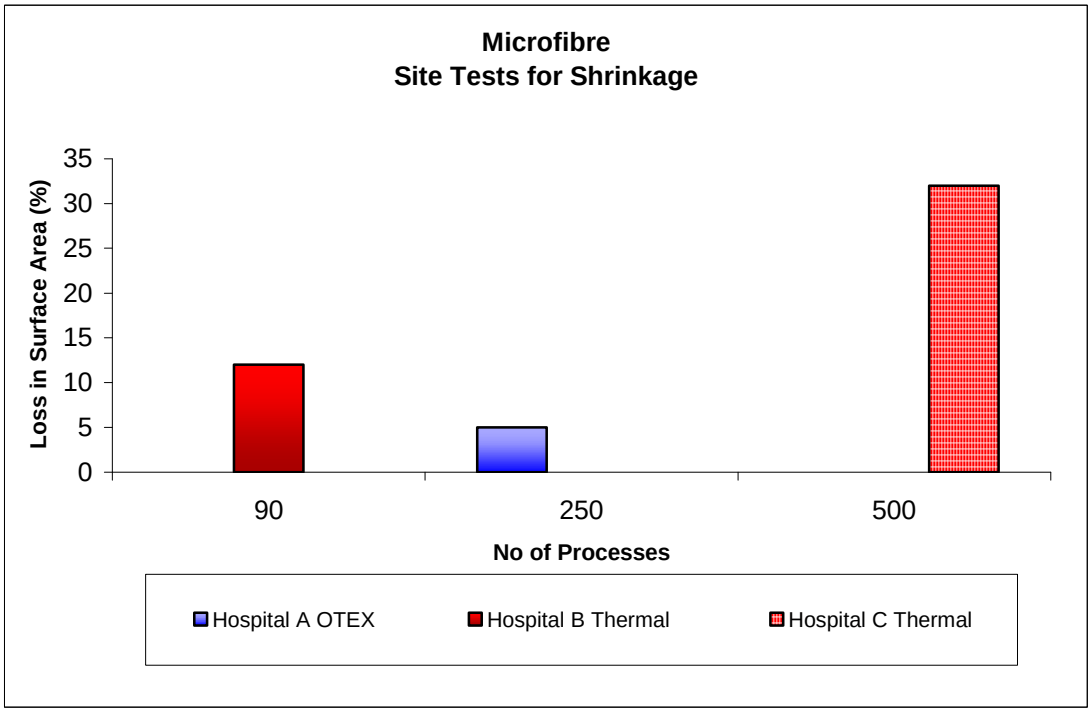


Table 5: Loss in Absorbency Laboratory Controlled Samples

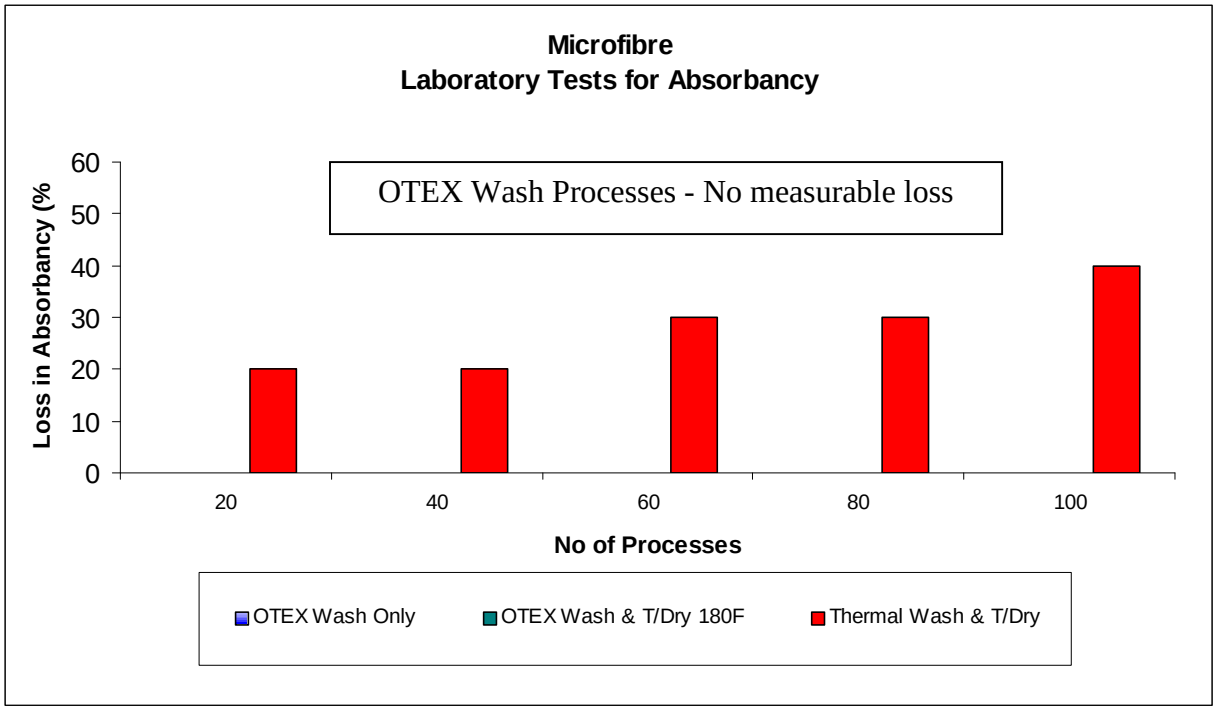
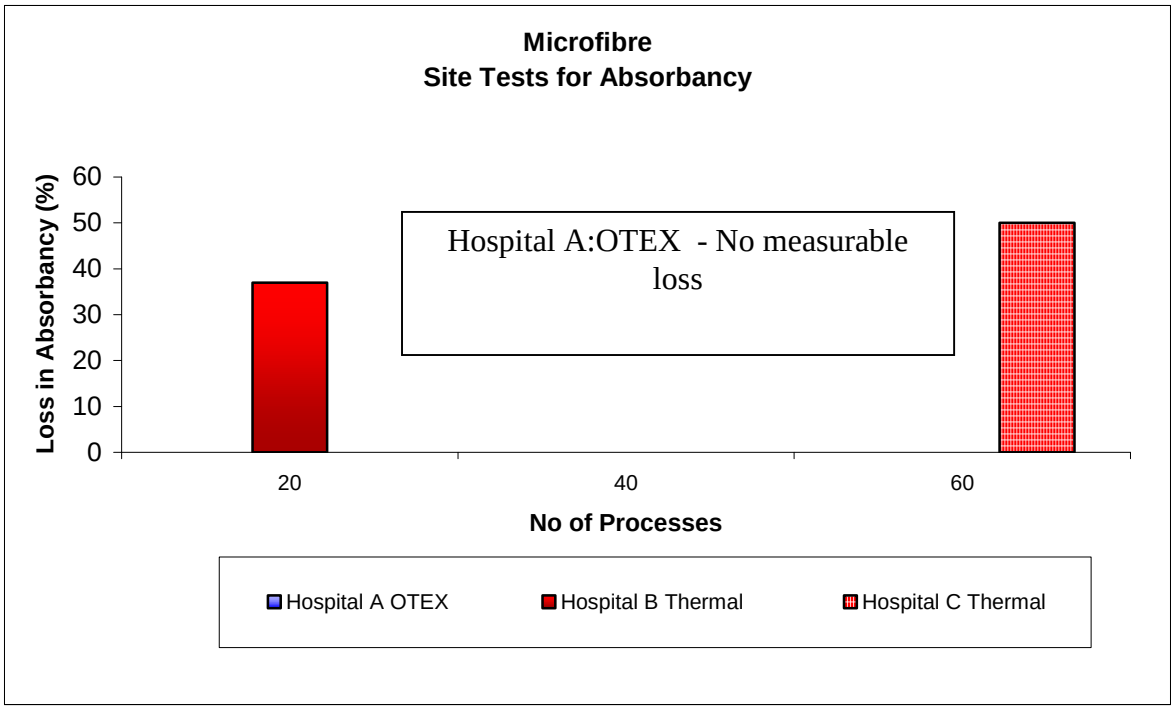


Table 6: Loss in Absorbency Site Samples



APPENDIX B:
SCIENTIFICS LTD REPORTS

Please note: The attached extracts are taken from original documents from Scientifics, which contain other data, which is out of the remit of this work. Full signed copies are available on request.

Laboratory Description of samples sent to Scientifics Ltd, Derby.

Reference F0325/06 – Electron microscopy of microfibre cloths March 2006

Sample ID:	Description
JLA A	**40 OTEX Washes**
JLA B	**40 OTEX Washes & Tumble Dry**
JLA C	**40 Thermal & Tumble Dry**
JLA D	**100 OTEX Washes**
JLA E	**100 OTEX Washes & Tumble Dry**
JLA F	**100 Thermal & Tumble Dry**
QE2 1	**250 OTEX Washes & Tumble Dry**
QE2 2	**250 OTEX Washes & Tumble Dry**

Reference F2111/06 – Electron microscopy of microfibre cloths November 2006

Sample ID:	Description
B	Hospital B Rochdale
E	Hospital C CRH

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500 London Road
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3rd March 2006

Dear Jackie

The purpose of this work was to carry out a microscopic examination of the structure of various microfibre cloth samples, and to comment of their gross structure and the appearance of the individual fibres. The table below lists the samples received and a description of the visual findings of the examination on these two levels.

Sample	Gross appearance	Fibre appearance
JLA A	Tight loops of fibres, still regularly arranged visibly in rows	Ribbon like fibres, virtually no damage/twisting noted
JLA B	Tight loops of fibres, still regularly arranged visibly in rows	Ribbon like fibres, very few twisted/damaged fibres noted
JLA C	Tight loops of fibres, still regularly arranged visibly in rows	Majority of fibres ribbon like, noted some twisting and small areas of knotted fibres
JLA D	Fibres still in discernible loops, however visibly looser	Ribbon like fibres, very little damage/twisting noted
JLA E	Tight loops of fibres, still regularly arranged visibly in rows	Majority of fibres show some twisting, although minimal, remainder are smooth and ribbon like
JLA F	Tight loops of fibres, still regularly arranged visibly in rows	Majority of fibres show some twisting, although minimal, remainder are smooth and ribbon like with occasional small knotted sections
QE2 1	Tight loops of fibres, still regularly arranged visibly in rows	Ribbon like fibres, virtually no damage/twisting noted
QE2 2	Tight loops of fibres, still regularly arranged visibly in rows	Fibres appear twisted/damages at top of loops, remainder all ribbon like

The visual examination of these samples showed no evidence of systematic chemical damage to the structure of the cloths or to the individual fibres. The damage that was noted is entirely more consistent with physical 'wear and tear', that is to say the twisting of individual fibres and general stretching of the loops of arranged fibres.

I hope that this information is of use to you.

Yours sincerely
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29th of November 2006

Dear Jackie

Laboratory reference F2111/06 – Electron microscopy of microfibre cloths

The purpose of this work was to carry out a microscopic examination of the structure of various microfibre cloth samples, and to comment of their gross structure and the appearance of the individual fibres. The table below lists the samples received and a description of the visual findings of the examination on these two levels.

Sample	Gross appearance	Fibre appearance
B	Tight loops of fibres, still regularly arranged visibly in rows	Ribbon like fibres, a few twisted/damaged fibres noted
E	Loops of fibres, still regularly arranged visibly in rows	Vast majority of fibres are still ribbon like. Small number are badly twisted.

The visual examination of these samples showed no evidence of systematic chemical damage/erosion to the structure of the cloths or to the individual fibres. The damage that was noted is entirely more consistent with physical 'wear and tear', that is to say the twisting of individual fibres and general stretching of the loops of arranged fibres. I include with this report digital copies of the micrographs of each sample of cloth.

I hope that this information is of use to you.

Yours sincerely

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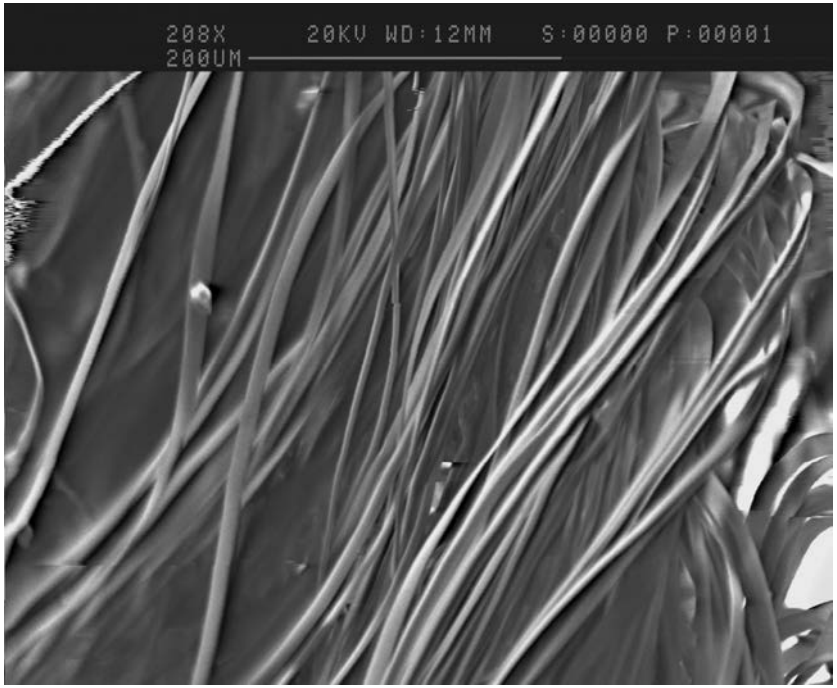
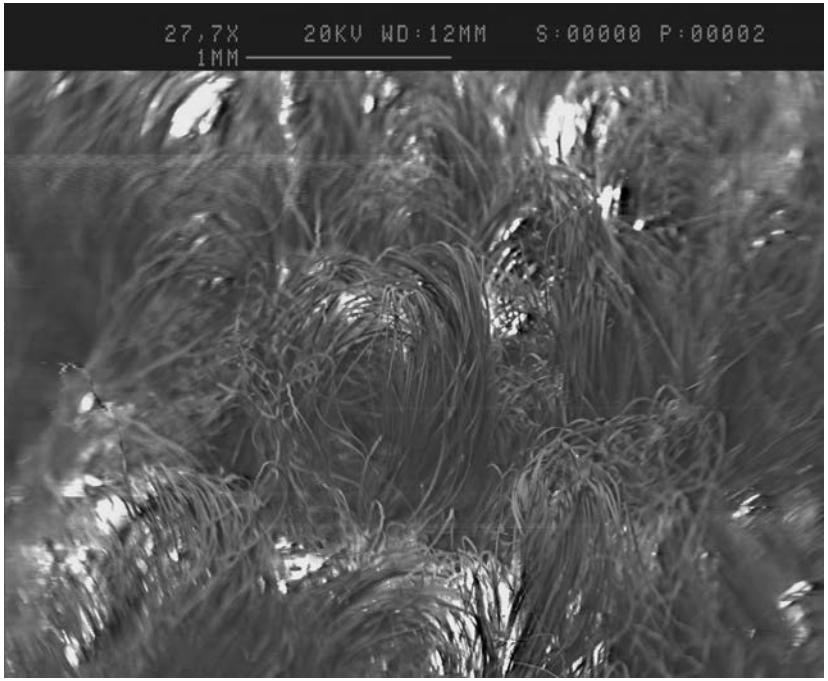
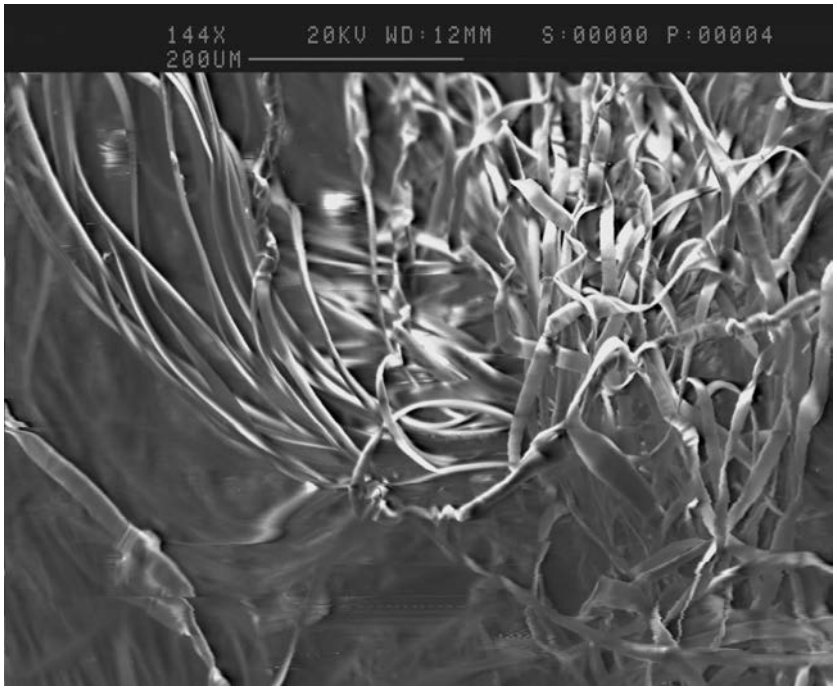
APPENDIX C:
SCIENTIFICS LTD ELECTRON MICROSCOPE IMAGING

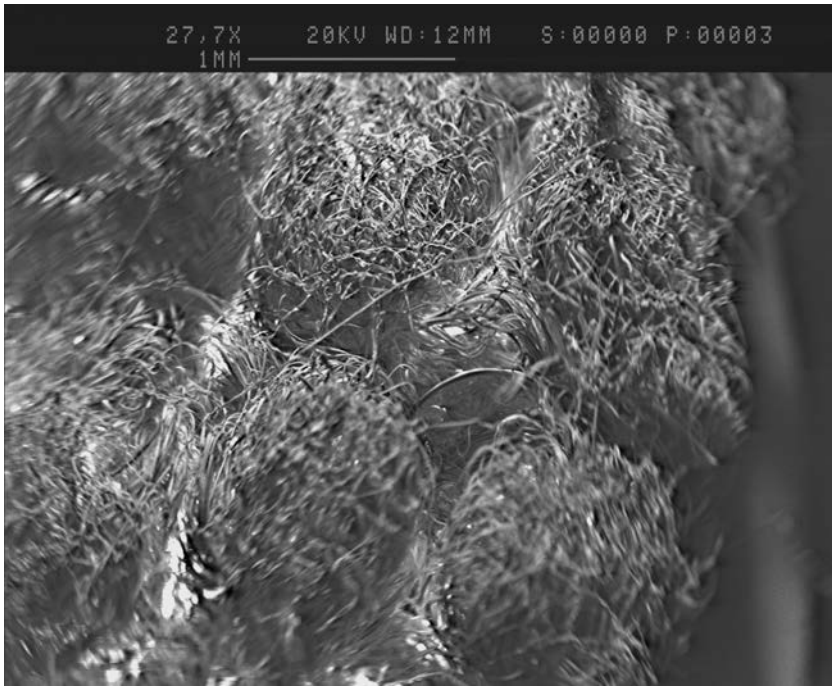
Electron Microscope Images: Microfibres After 40 OTEX Washes No Tumble Drying



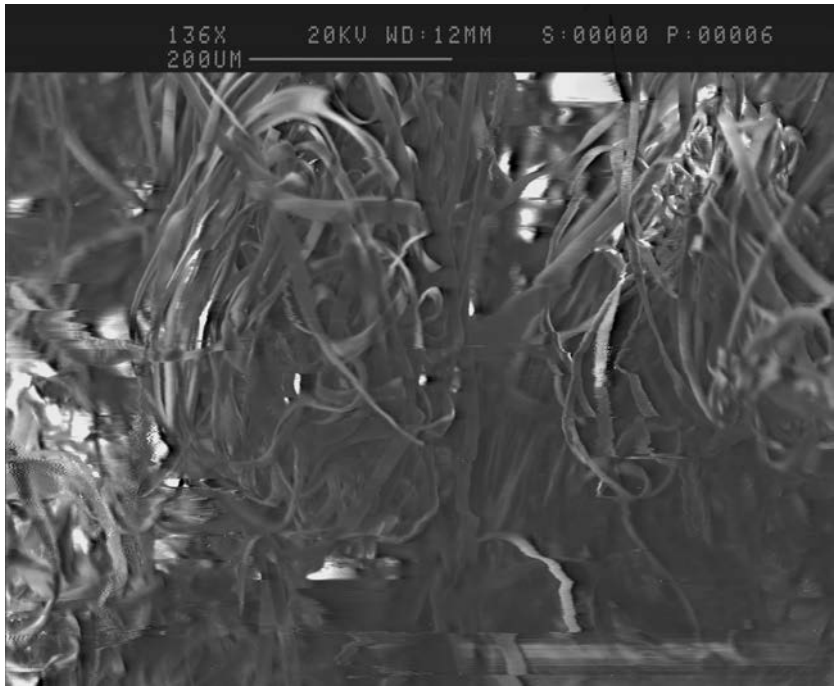


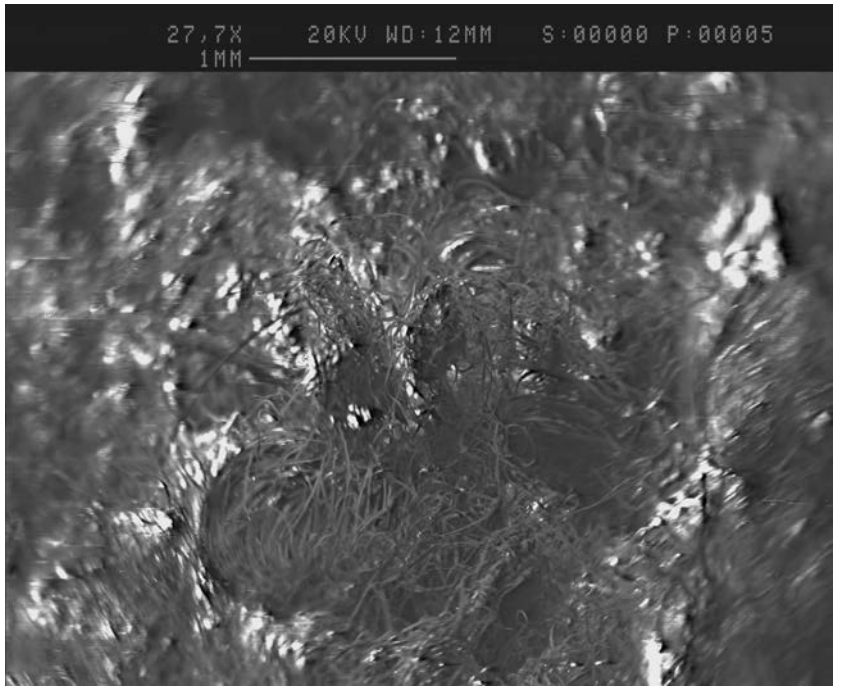
Electron Microscope Images: Microfibres After 40 OTEX Washes & Tumble Drying @180F



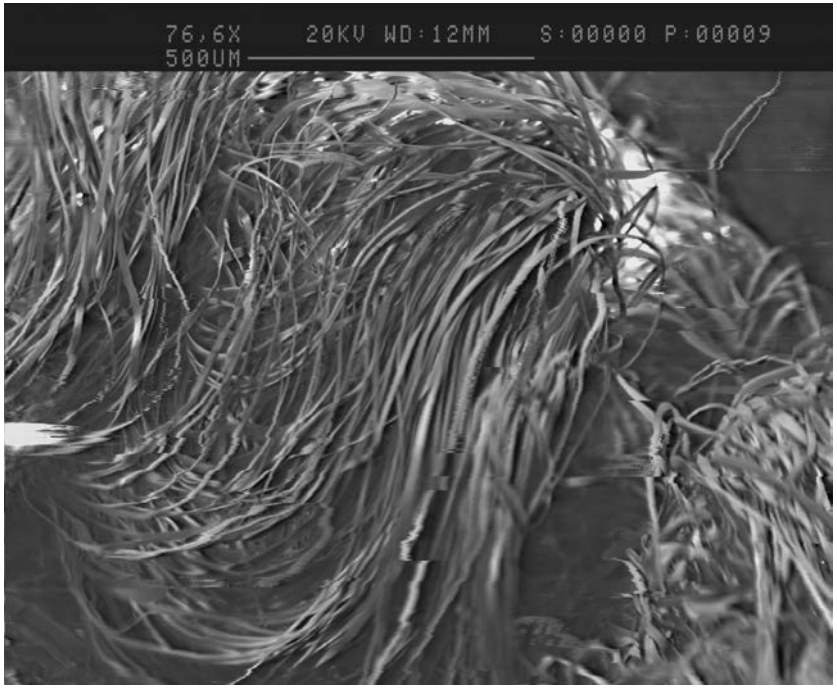


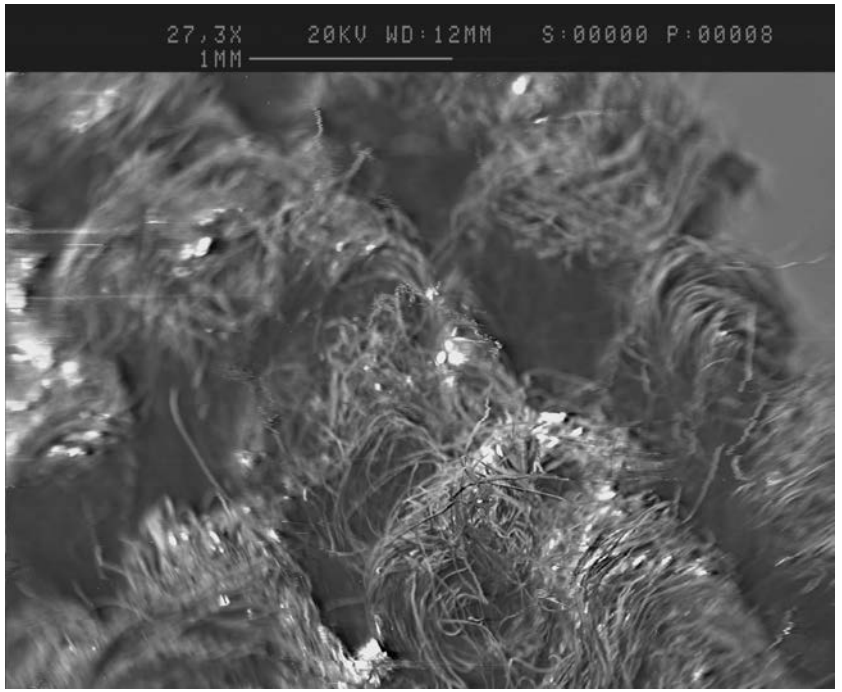
Electron Microscope Images: Microfibres After 40 Thermal Washes & Tumble Drying @ 180F



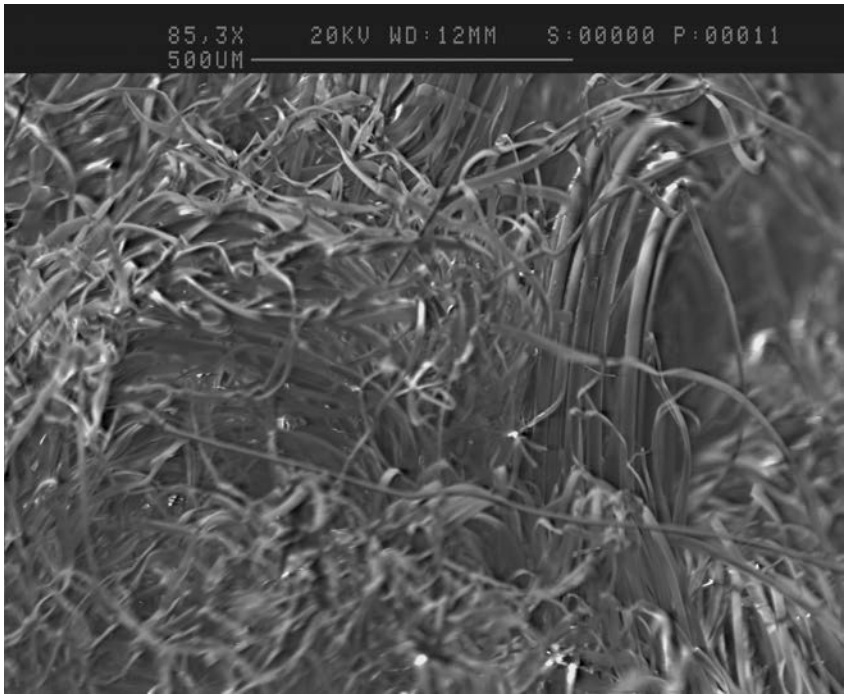


Electron Microscope Images: Microfibres After 100 OTEX Washes No Tumble Drying

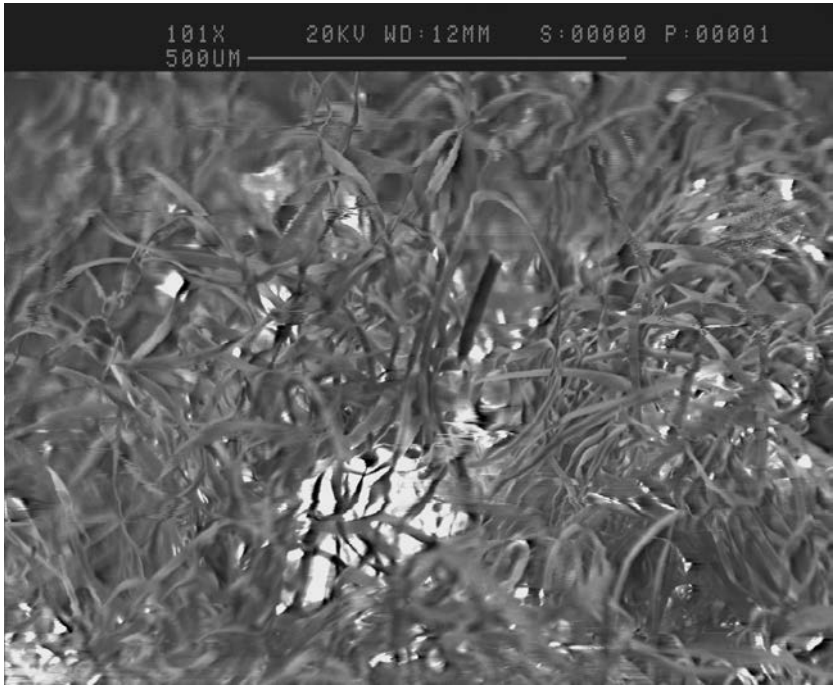


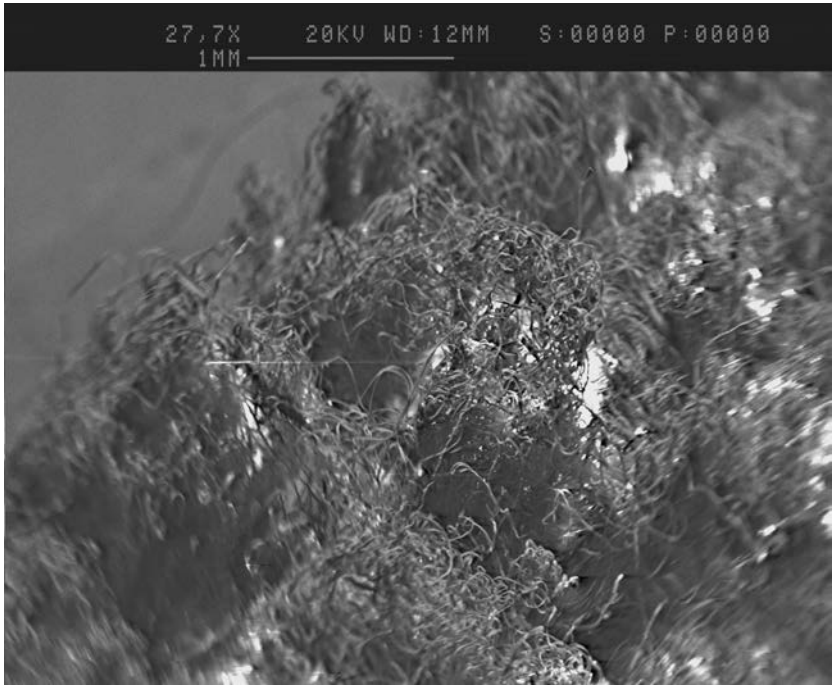


Electron Microscope Images: Microfibres After 100 OTEX Washes & Tumble Drying @180F

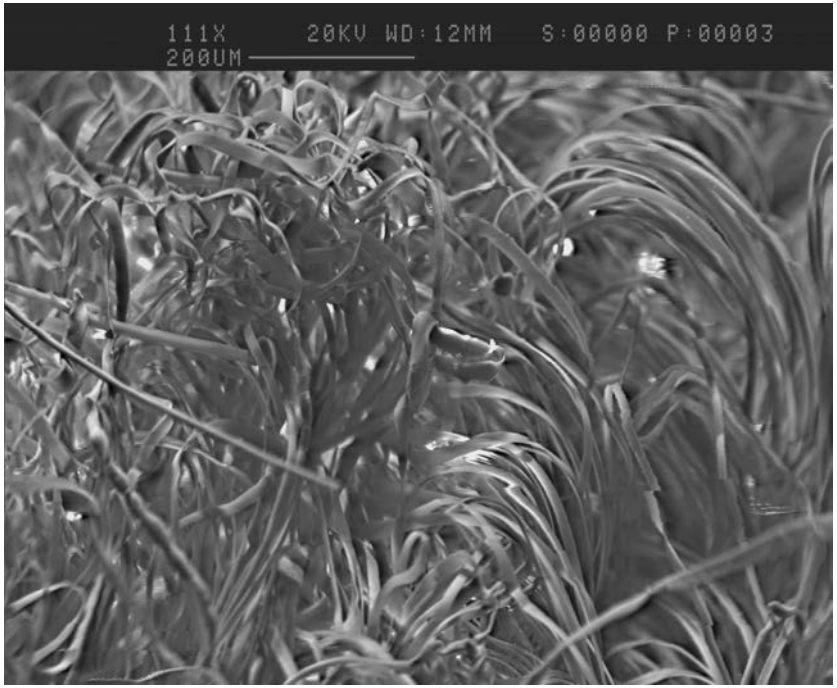


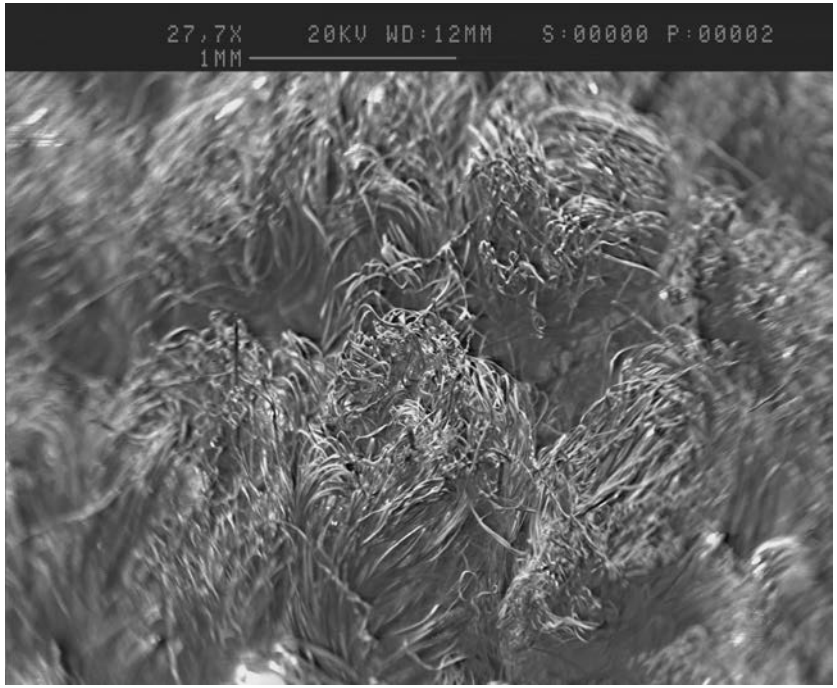
Electron Microscope Images: Microfibres After 100 Thermal Washes & Tumble Drying @180F



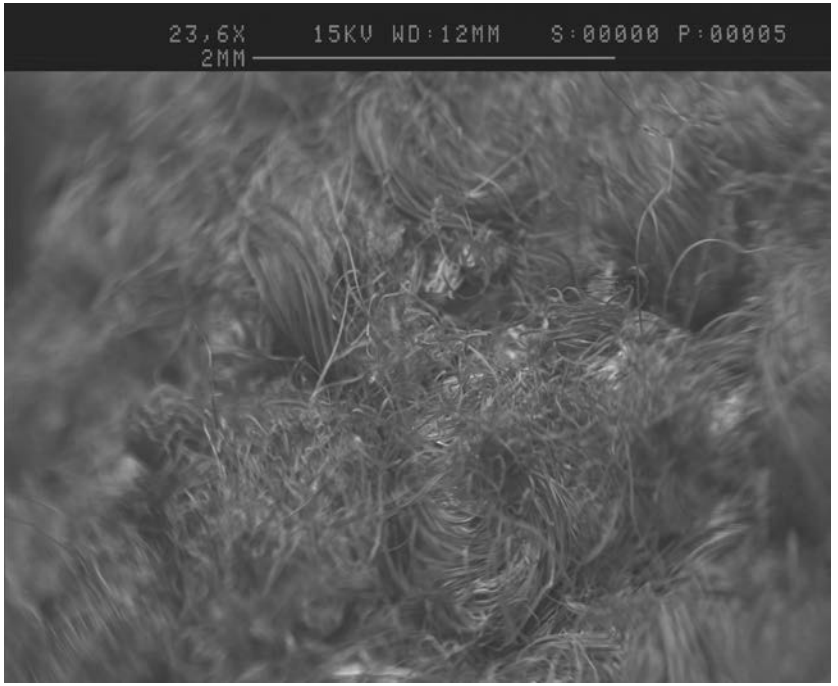


Electron Microscope Images: Hospital A QEII Trial Microfibres After 250 OTEX Washes & Tumble Drying @180F – 140F

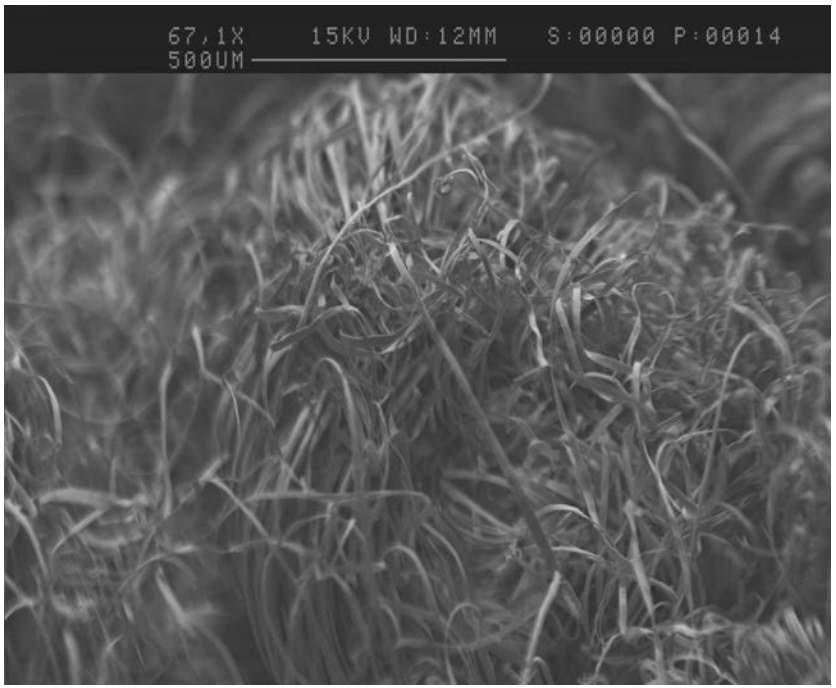


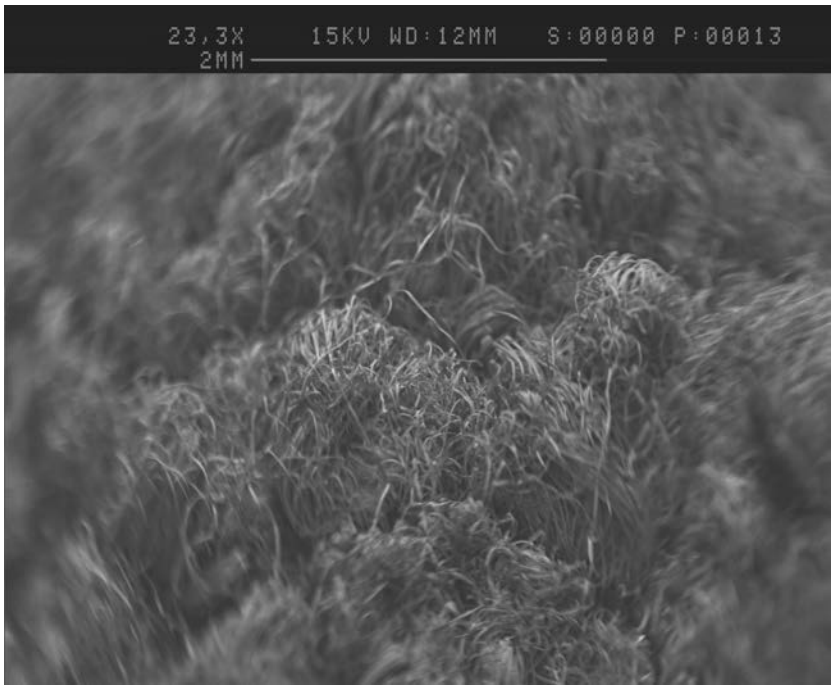


Electron Microscope Images: Hospital B Microfibres After 90 Thermal Washes & Tumble Drying @180F



Electron Microscope Images: Hospital C Microfibres After 500 Thermal Washes





APPENDIX D:
REFERENCE MATERIAL

Main recommendations from ACT® for washing cycle

ACTIVITY	WATER LEVEL	TIME	TEMPERATURE
Fill washer drum Filling degree = 60% E.g. 6 kg of dry wash will go into a 10-kg machine			
Pre-rinse Drain Valve Extraction	High	5 min 1 min	20°C/68 F (cold tap water)
Pre-wash Drain Valve	Low	5 min	30°C/86 F
Main wash Cooling Drain Valve	Low	15 min 2°C/min	92°C/197.6 F 92° – 60°C/ 197.6 F - 140 F
Rinse 1 Drain Valve Extraction	High	3 min 1 min	20°C/68 F (cold tap water)
Rinse 2 Drain Valve Extraction	High	3 min 1 min	20°C/68 F (cold tap water)
Rinse 3 Drain Valve Extraction:	High	3 min	20°C/68 F (cold tap water)

ACT® Cleaning Cloth should contain 300% water for the best cleaning results.

ACTEX® Damp Mop and ACT® Damp Mop should contain 175% water for the best cleaning results.

ACTEX® Dry Mop and ACT® Dry Mop should be as *dry* as possible.

The washing powder is normally used only in the main wash.
Never add a rinsing agent or softener!

General Recommendations

- Do not wash ACT® Cleaning Cloth together with ACTEX® Mops or ACT® Mop.
- Do not wash ACTEX® Damp Mop or ACTEX® Dry Mop together with ACT® Dry Mop of fluffy fibre.

Colours may run if coloured clothes/mops are washed together with uncoloured ones. Any discolouring will, however, not affect the cleaning characteristics of the material.

How ACTEX® fibre is affected by disinfectant and cleaning chemicals:

Breakdown of polyester/polyamide material

In strong alkaline solutions, such as caustic soda (sodium hydroxide), polyester fibre can be broken because its outer layer is peeled away. The rate of peeling increases along with increasing alkalinity (or pH) and increasing water temperature (over approx. 40°C).

If a cationic disinfectant, such as quaternary ammonium compounds, is added to the alkaline solution, a catalytic breakdown of the polyester material will take place, causing it to quickly lose its strength.

In reality this often happens when cationic disinfectants are used as bacteria killing additives when cleaning with damp mops and other cleaning fabrics of polyester / polyamide.

After use the cleaning fabrics contain remains of cationic disinfectant and when they are washed in a strong alkaline solution, at high temperature, a sharp increase (catalytic) in the breakdown of the polyester fibre occurs. The result is that the textile material deteriorates and tears.

Two solutions to the problem:

A. Avoid using cationic disinfectants for disinfecting.

B. Remove such chemicals from the textile material before it is introduced in the alkaline washing solution. This can be done by adding a pre-rinse (high water level and not over 40°C) to the washing cycle followed by a extraction. In this way most of the cationic disinfectant will be eliminated before the material ends up in the alkaline washing solution.

NOTE!
Chlorine compounds must not be used to replace cationic disinfectants as they can damage polyamide fibre.

Main recommendations for washing powder:

ACT® Washing Powder

- ACT® Washing Powder is specially designed and adapted for washing ACT®'s products. It preserves and extends the life of the products, and gets ACTEX® fibre thoroughly clean without affecting its function negatively.
- Contains neither bleach nor any other ingredients that can damage ACTEX® fibre.
- Cleans without leaving deposits or in any other way damaging the cleaning properties of ACT® products.
- Also effectively cleans other types of fabric and can be used for all types of wash, e.g. delicate, colour and white.
- Is a compact washing powder, which means it only contains the ingredients necessary for attaining maximum cleaning effect. The amounts required are therefore the lowest possible.
- Meets the criteria of the seal of approval of SSNC the Swedish Society for the Conservation of Nature.

Dosage instructions for ACT® Washing Powder:

Load Size				
Normally soiled wash	1-2 kg	3-4 kg	5-6 kg	10 kg
Soft water 0-6 dH°	0.3 dl	0.5 dl	0.75 dl	1.5 dl
Medium hard water 7-15 dH°	0.3 dl	0.75 dl	1.0 dl	2.0 dl
Hard water 16-20 dH°	0.4 dl	1.0 dl	1.5 dl	3.0 dl
Heavily soiled wash	1-2 kg	3-4 kg	5-6 kg	10 kg
Soft water 0-6 dH°	0.5 dl	0.75 dl	1.0 dl	2.5 dl
Medium hard water 7-15 dH°	0.45 dl	1.0 dl	1.5 dl	3.0 dl
Hard water 16-20 dH°	0.6 dl	1.5 dl	2.0 dl	3.5 dl

If you do not use ACT® Washing Powder, keep this in mind:

- Use a synthetic washing powder of non-ion type.
- Washing powder for colour wash is usually the most suitable.
- Washing powders are almost always more effective than washing liquids.
- Detergents should be of non-ion type, e.g. tallowfatty alcohol ethoxylate.
- Soap and zeolites should not be in the washing powder.
- Perfumes and optical bleaching agents do not improve the function of a washing powder.

This is how your ACT® products are affected by improper care:

- Soap and zeolites are deposited on the ultrafine microfibre surfaces upon every wash and, after a time, the fibres stick together. They reduces capillary action.
- Optical bleaching agents have little effect on polyester at normal washing temperatures and are therefore unnecessary.
- If spot removing is required on occasion, i.e. if bleaching, add sodium percarbonate instead.