



Benetton Group srl

APEOs/APs Elimination Progress

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Introduction, scope and purpose

As part of its zero discharges pledge, Benetton Group (Benetton) is committed to completely eliminating all Alkylphenol Ethoxylates (APEOs) from all its products and processes.

The scope and purpose have been declared in the [Benetton Group's Detox Commitment to zero discharges](#)¹.

An investigation into the level of compliance with the [Benetton Group's RSL](#)² has begun and has led to more stringent/exacting contracts with suppliers that call a progressive reduction of APEOs while aiming for their complete elimination. We are working in partnership with the supply-chain and other textile's global leaders to move quickly towards finding alternatives to APEOs. The result will be ensured by a rigorous system of controls to check for possible traces in the supply-chain.

Foreword, Concept and Background

What are APEOs?

Alkylphenol Ethoxylates (APEOs) are included in the group of non-ionic surfactants that have an emulsifying and dispersing action; they have good wetting, penetration, emulsification, dispersion, solubilizing and washing characteristics.

This makes them suitable for a very large variety of applications: they have been used for over 50 years in a wide variety of products.

In the textile industry, they are commonly used in spinning oils, detergents and as a scouring, coating or wetting agents, softeners, in printing pastes, in adhesives and in dyeing as dispersing agents.

The most important APEOs for the textile industry are the Nonylphenol Ethoxylates (NPEOs) and the Octylphenol Ethoxylates (OPEOs). NPEOs represent the largest share of produced APEOs.

Difference between APEOs and APs

Nonylphenol ethoxylates (NPEOs) and Octylphenol ethoxylates (OPEOs) break down into a toxic, persistent and bioaccumulative forms called Nonylphenol (NP) and Octylphenol (OP), respectively, and they belong to the Alkylphenols (APs) class of substances.

Biodegradation of NPEOs into NP is the main source of NP in the environment.

For greater convenience in the prosecution only APEOs will be mentioned but also APs group has to be considered by the same standard.

Legislation

Legislation around the world restricts the use of some APEOs and APs.

Pending legislation in the European Union aims to restrict their use in textile products.

Benetton Groups has banned the use of APs and APEOs in manufacturing process and all its products.

¹ http://assets.benettongroup.com/wp-content/uploads/2016/05/Benetton_Group_Detox_Commitment.pdf

² <https://www.benettongroup.com/en/sustainability/detox/rsl/>

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Safer NPEOs Alternatives

The following substances have been identified as examples of safer NPEOs alternatives by the U.S. Environmental Protection Agency Design for the Environment Program.

68439-46-3	C9-11 alcohols, ethoxylated (6EO)
68131-39-5	C12-15 alcohols, ethoxylated (9EO)
64366-70-7	Oxirane, methyl-, polymer with oxirane, mono(2-ethylhexyl ether); Ecosurf EH-9
68515-73-1	Glucopyranose, oligomeric, decyl octyl glycosides
68411-30-3	Benzenesulfonic acid, C10-13-alkyl derivs., sodium salt
151-21-3	Sodium lauryl sulfate
9004-82-4	Polyoxy(1,2-ethanediyl), alpha-sulfo-omegadodecyloxy-, sodium salt
1338-41-6	Sorbitan monostearate

They may be suitable for suppliers production needs. Any chosen alternative must be Benetton RSL compliant.

Additional information about these alternatives is available at the following link:

<https://www.epa.gov/saferchoice/partnership-evaluate-alternatives-nonylphenol-ethoxylates>

Safer NPs Alternatives

Calcium/zinc stabilizers containing no NP-based antioxidants are considered safer NPs alternatives and they are available on the market.

Benetton furthermore encourage its supply chain to keep visiting ZDHC website (<https://www.roadmaptozero.com/documents> - section Input), in which fact sheets on NPEOs and NPs, and some others substances are always available and updated.

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Progress and Achievements

What Benetton Group is doing

Since January 2011, Benetton Group began testing its products to verify compliance within REACH³ (Registration, Evaluation, Authorization and Restriction of Chemicals) limits.

At that time APEOs were regulated by a Benetton Group's internal document that - to coincide with the signing of Detox Commitment 2013 - converged into the Restricted Substances List (RSL).

Screening methodology on APEOs, as well as verification of other chemicals on products, are well defined by a calculation tool based on recognized statistical methods and on suppliers' basis. Annually thousands of tests are conducted on raw materials, semi-finished and finished goods.

Benetton Group's progresses and achievements on APEO elimination are schematized in Figure 1.

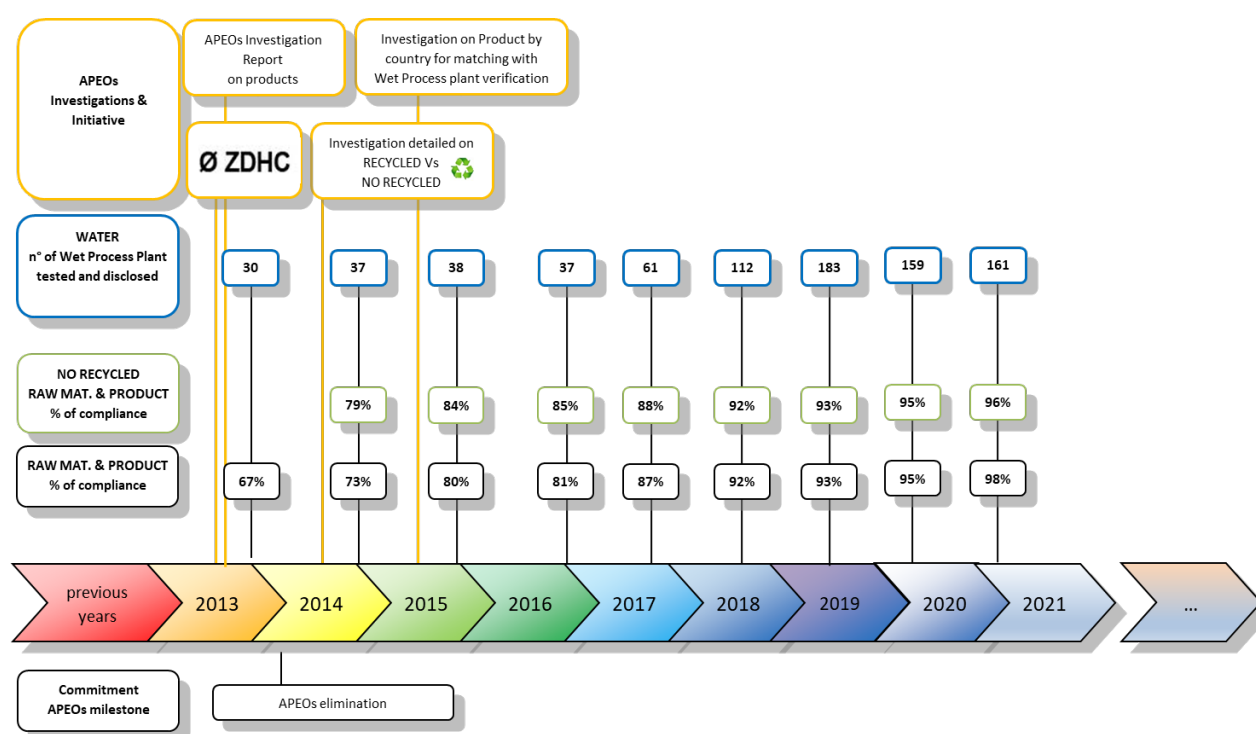


Figure 1 Scheme of Benetton's actions in the APEOs/APs elimination

³ <https://echa.europa.eu/regulations/reach/legislation>

The latest year

2021 – In spite of the increasing compliance result, Benetton is not giving up on the goal to completely eliminate APEOs/APs and it continues monitoring its production processes to achieve it. Starting from this year, a new compound, namely the 4-tert-butylphenol (BP), has been tested.

By considering that the global production was still affected by the Covid-19 pandemic consequences, a big number of wet process plants has been verified through the Benetton's Detox Programme. More than 160 facilities, in fact, performed both wastewater tests (according to the ZDHC Wastewater Guideline) and assessments on chemical management, work practice, environmental permits, sustainable resource use, emission etc. (by filling the Higg FEM).

Concerning products, the total number of tests performed during 2021 is 1307 and they refer to 14 countries: BANGLADESH, BRAZIL, CHINA, CROATIA, EGYPT, HONG KONG, INDIA, ITALY, SOUTH KOREA, PORTUGAL, SPAIN, THAILAND, TUNISIA and TURKEY.

Results show the total compliance is almost reached: detected values are very low, and this is the reason why they could be ascribed to unintentional use of these substances.

The experience during the years

2013 – Throughout 2013, Benetton kept on testing, looking at compliance verification based on the new Benetton RSL, which had issued in January. For the first time, the APEOs limits were not legally binding but much more restrictive as result of a voluntary action.

In June 2013, Benetton joined the [Zero Discharge of Hazardous Chemicals \(ZDHC\) Programme](#)⁴, to cooperate with other leading brands and retailers committed to the 2020 target of eliminating hazardous chemicals from the textile industry.



In July 2013, Benetton Groups made an APEOs' [Investigation Report](#)⁵ that brought to light that there was an important percentage of no-compliance relating to the fabrics including “recycled materials”.

Committed to the “right to know” principle, in 2013 Benetton also began testing discharges of hazardous chemicals into water used in the Wet Process plants within its supply-chain. Sampling and tests were conducted by independent and accredited third-party laboratories and results are disclosed in [Benetton's web site](#)⁶ for each facility. Concerning the Chinese plants, results are also disclosed on the online platform of the Institute of Public and Environmental Affairs (IPE). The list of Chinese plants with their respective IPE link is also published in the [Benetton's website](#)⁷.

Consistently with the finding, Benetton noticed some of its suppliers that were been found “positive to APEOs” requesting to immediately only use APEO-free chemicals (where “free” means zero).

Acting consistently, Benetton appointed a third party-auditor to carry out environmental audits, the goal being raise awareness among suppliers of the importance of using chemicals correctly, safeguarding the environment and protecting resources.

⁴ <http://www.roadmaptozero.com/>

⁵ http://assets.benettongroup.com/wp-content/uploads/2016/05/Benetton_APEO_Investigation.pdf

⁶ <http://www.benettongroup.com/sustainability/detox/wet-process/water-test-results/>

⁷ <http://www.benettongroup.com/sustainability/detox/wet-process/ipe-disclosure/>

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2014 - Aware of recycling's important contribution to environmental protection – in terms of saving energy, reducing water consumption, and reusing raw materials - otherwise used for producing new materials and recognizing that using **recycled materials** in fabrics helps in the preservation of global climate, since 2014 Benetton has been looking closely at recycling and studying in depth the impact recycled materials have on the fabrics that use them.



The consequent decision has been the identification of the materials containing “any percentage of recycled”, keeping them separate in the reporting to highlight the different levels of compliance between “materials containing recycled” Vs “materials not containing recycled”.

2015 - Wanting to make further enquiries in order to identify the source of APEOs contamination, in 2015 Benetton began to consider also the country of origins of the fabrics it uses. In this way, any issues can be directly cross-checked with results of the local water test investigation.

2016 – To reach the goal of total elimination, Benetton continues the APEOs/APs investigation in all its products and processes. In 2016 Benetton's most important supplier OLIMPIAS Group s.r.l. - with its 6 facilities located in 4 different countries of EMEA (Croatia, Italy, Serbia and Tunisia) – has been submitted to the tests.

Furthermore, OLIMPIAS Group s.r.l. is the project leader of [WASATEX](http://wasatex.eu)⁸; this project, supported by the European Union, aims to get water reusable into industrial production cycle through wastewater treatment considering it a prerequisite for reducing the environmental impact of industrial processes.

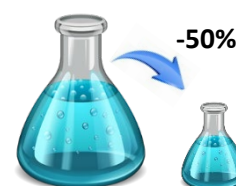


Regarding wet process plants, verifications have been conducted by third parties not only in Europe but also in many other countries, such as India and China.

More than 1000 tests on products have been performed in 20 countries.

2017 – Benetton decided to adopt the ZDHC Wastewater Guideline, thanks to which the number of verified wet process plants increased more than 50% compared to the previous year.

In line with the trend started in 2013, also in 2017 compliance result continued to increase, therefore in September 2017, Benetton Group decided to make a new challenge halving in its RSL the limit values of NP, OP and APEOs in products, including also some additional compounds such as Pentyphenol (PP) and the Heptyphenol (HP).



2018 – With the adoption of the ZDHC Wastewater Guideline and the Higg FEM, the number of verified wet process plants continued increasing also in 2018. Concerning products, 1451 tests have been performed during this year and their results show the continuous growing of compliance percentage, in line with the historical trend started in 2013.

⁸ <http://wasatex.eu>

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2019 – In line with the results obtained in the previous year, also in 2019 the number of verified wet process plants has increased of more than 50%. The continuous growing of compliance percentage is in line with the historical trend, as shown by the results of the 1757 tests performed on products. Also regarding products, in 2019 there has been an increase of almost 20% comparing to 2018.

2020 – By considering that the global production was completely stopped for some months due the Covid-19 pandemic, a big number of suppliers have been tested both in their processes. More than 150 wet process facilities have provided wastewater test and more than 1600 test have been performed on products . Results show the total compliance is almost reached: detected values are very low and this is the reason why they could be ascribed to unintentional use of these substances.

Data and Graphs

Results of the analysis performed in 2021 are presented in the following tables, by considering, respectively, all materials (i.e. including material containing recycled, 1307 test) rather than the materials non containing recycled (1268 test). In particular, tables 1 and 2 present the number of tests that have been performed, while tables 3 and 4 present the percentage of detected compounds.

Concentration range <i>ppm</i>	APEOs-APEOs # of tests	BP # of tests	NP # of tests	OP # of tests	PP # of tests	HP # of tests	NPEs # of tests	OPEs # of tests
> 500	0	0	0	0	0	0	0	0
50 - 500	6	0	0	0	0	0	6	0
3 - 50	44	0	0	0	5	0	36	0
Not Detected	1280	1307	1307	1307	1302	1307	1267	1307
Total	1307	1307	1307	1307	1307	1307	1307	1307

Table 1. Number of APEOs/APs tests performed in 2021 grouped by *concentration range (ppm)* and *detected substances (BP, NP, OP, PP, HP, NPEs, OPEs)*.

Concentration range <i>ppm</i>	APEOs-APEOs # of tests	BP # of tests	NP # of tests	OP # of tests	PP # of tests	HP # of tests	NPEs # of tests	OPEs # of tests
> 500	0	0	0	0	0	0	0	0
50 - 500	5	0	0	0	0	0	5	0
3 - 50	43	0	0	0	0	0	35	0
Not Detected	1221	1268	1268	1268	1268	1568	1231	1268
Total	1268	1268	1268	1268	1268	1268	1268	1268

Table 2. Number of APEOs/APs tests performed in 2021 on material non containing recycled, grouped by *concentration range (ppm)* and *detected substances (BP, NP, OP, PP, HP, NPEs, OPEs)*.

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Concentration range <i>ppm</i>	APs-APEOs (%)	BP (%)	NP (%)	OP (%)	PP (%)	HO (%)	NPEs (%)	OPEs (%)
> 500	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
50 - 500	0,5%	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%
3 - 50	3,4%	0,0%	0,0%	0,0%	0,4%	0,0%	2,8%	0,0%
Not Detected	97,9%	100,0%	100,0%	100,0%	99,6%	100,0%	96,9%	100,0%

Table 3. Percentage of detected APEOs/APs in 2021 grouped by concentration range (*ppm*) and detected substances (*BP, NP, OP, PP, HP, NPEs, OPEs*).

Concentration range <i>ppm</i>	APs-APEOs (%)	BP (%)	NP (%)	OP (%)	PP (%)	HP (%)	NPEs (%)	OPEs (%)
> 500	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
50 - 500	0,4%	0,0%	0,0%	0,0%	0,0%	0,0%	0,4%	0,0%
3 - 50	3,4%	0,0%	0,0%	0,0%	0,0%	0,0%	2,8%	0,0%
Not Detected	96,3%	100,0%	100,0%	100,0%	100,0%	123,7%	97,1%	100,0%

Table 4. Percentage of detected APEOs/APs in 2021 on material non containing recycled, grouped by concentration range (*ppm*) and detected substances (*BP, NP, OP, PP, HP, NPEs, OPEs*).

By comparing results from 2013 to 2021, it is possible to see how the compliance (i.e., the % of *Not Detected*) is increasing year by year (Figure 2), both considering recycled material included and excluded.

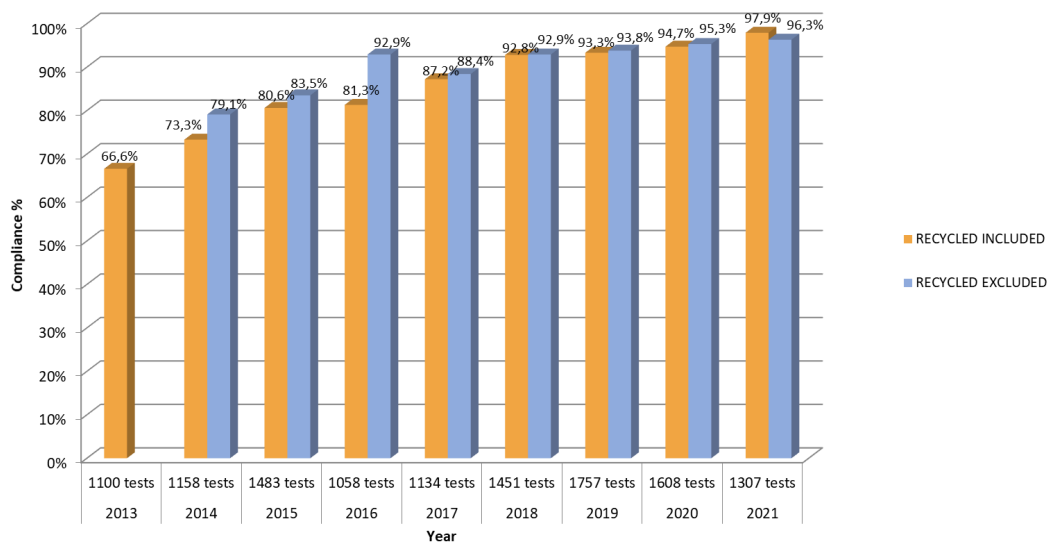


Figure 2 APEOs/APs Compliance percentage during the years.

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Concerning the comparison of the "concentration range", because of the change of the threshold (from >1000, 100-1000, 3-100 to >500, 50-500, 3-50, respectively) is not possible to fully compare historical data with the most recent. The following figure 3 and 4 show what happened till 2017.

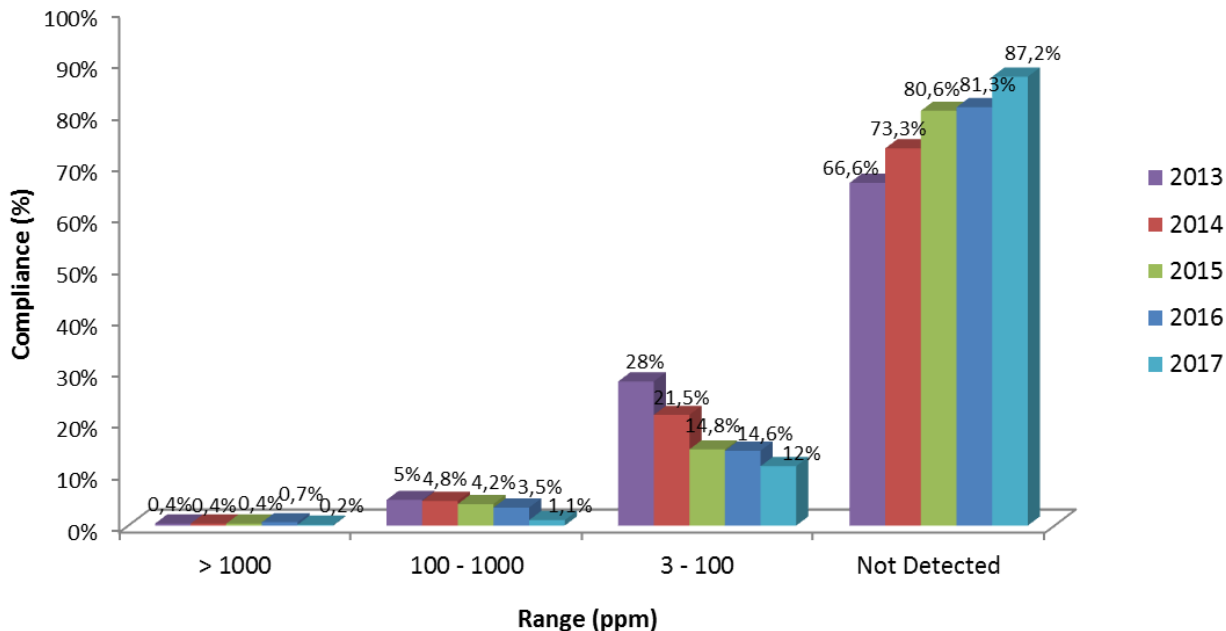


Figure 3 "Recycled included" compliance percentage by concentration range from 2013 to 2017.

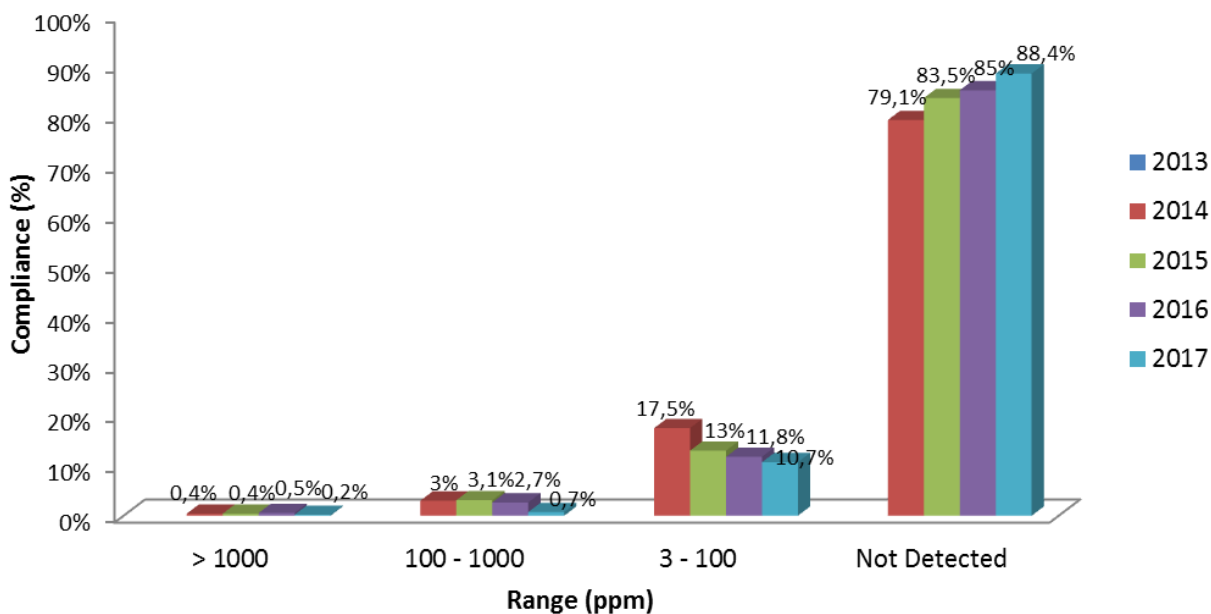


Figure 4 "Recycled excluded" compliance percentage by concentration range from 2013 to 2017.

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To ensure continuity and for a better understanding, 2017 results have been compared with those of the last four years (i.e. 2018, 2019, 2020 and 2021) by combining the respective concentration ranges as shown in Figure 5 and Figure 6. They confirmed that further progresses have been achieved even in the 2021.

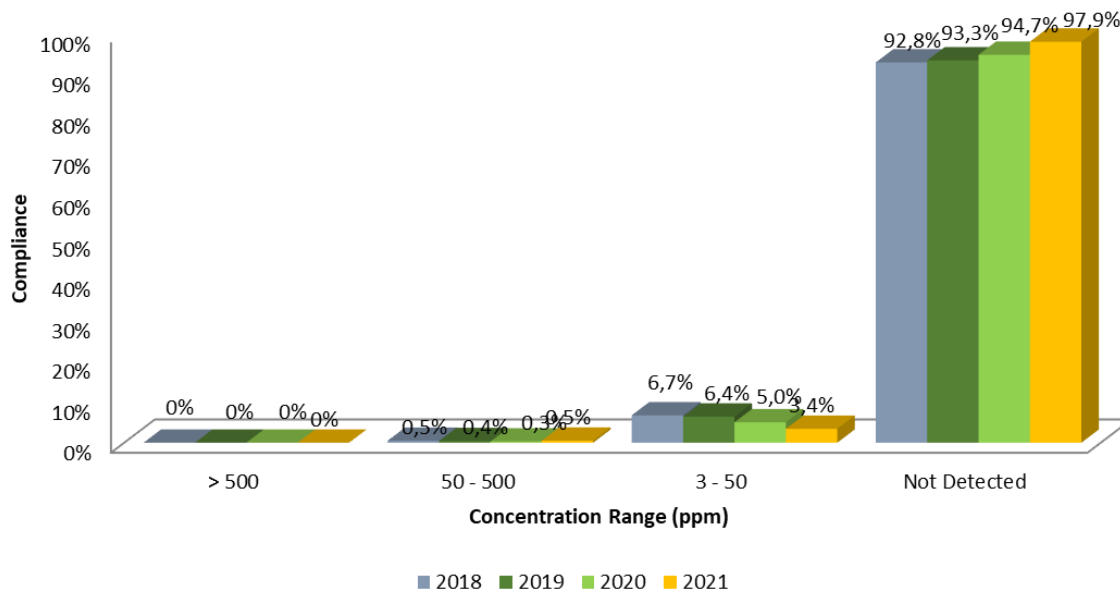


Figure 5 “Recycled included” compliance percentage by concentration range in the years 2018, 2019 and 2020.

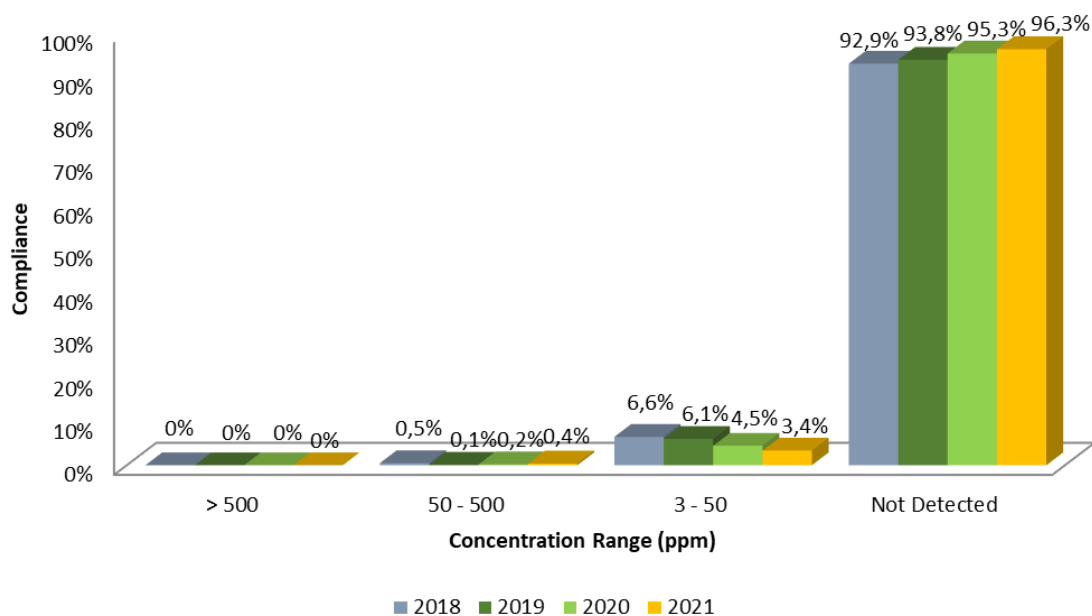


Figure 6 “Recycled excluded” compliance percentage by concentration range in the years 2018, 2019 and 2020.

Water Tests

As shown in Figure 1, simultaneously to the APs/APEOs tests on the products, since 2013 Benetton is also testing discharges of hazardous chemicals into water used in the Wet Process plants within its supply-chain.

Until 2016, tests consisted in sampling water in three crucial points: *Raw Waste Water - RWW* (sampled at the end of the production line), *Incoming Water – InW* (sampled at the water sourcing point), *Treated Waste Water - TWW* (sampled at the exit of the Effluent Treatment Plant) and testing them for all 11 DETOX Chemical Groups⁹ plus Cyanide. In particular, *RWW* is tested for all 12 chemical groups, *InW* and *TWW* are tested in case of findings on *RWW* and focused on founded groups.

Starting from 2017, with the adoption of the ZDHC Wastewater Guideline, 18 groups are tested: Conventional Parameters, Heavy metals and Cyanide, Alkylphenols and Alkylphenols Ethoxylates (APs/APEOs), Chlorobenzenes and Chlorotoluenes, Chlorophenols, Dyes – Azo, Dyes – Carcinogenic, Dyes – Disperse, Flame Retardant, Glycols, Halogenated Solvents, Organotin Compounds, PFCs, Phthalates, Poly Aromatic Hydrocarbons (PaHs), Volatile Organic Compounds (VOCs).

As already noted in previous sections, all results are available on the Benetton's website and, for Chinese plants, also in the IPE website. In particular, during 2021, water at 161 plants have been tested and their respective reports have been disclosed on Benetton's website. For 40 of these plants the link to the IPE platform is also available^{10 11}.

Next steps ...

Benetton will continue to control for APEOs over the coming years by creating awareness in the entire supply chain, through products verification (as much as possible at the source, then focused on raw materials and compliance of chemical formulations) and locally by testing waters, as well as through environmental audits. As mentioned before, sampling, testing and auditing activities will be appointed to third-party.

Over the years, Benetton has reached the awareness that the total elimination of APEOs is intrinsically difficult (especially when referring to products that, to protect the environment and resources, are recovered from previous uses), the Group has taken concrete actions to reach the ambitious goal that had set in 2013. Even if 2020 marked the deadline for the Detox Commitment, Benetton efforts will not stop but, on the contrary, they will continue by further strengthening its RSL.

According to this, in the due course of the 2022 the list of the APEOs compounds to monitor could increase as well as the limits could be lowered.

Experience in this field will surely lead to more information about the benefits of a cleaner production in the supply chain.

Partnerships with chemical industries are leading to the development of further positive lists of chemical products and formulations that comply with Benetton's RSL.

Being firm in its purpose, Benetton continues the intensive test program to identify contamination sources on materials and products, addressing specific communication and "best practices" suggestions.

⁹ Alkylphenols and Alkylphenols Ethoxylates (APs/APEOs), Chlorinated Benzenes, Chlorinated Phenols, Colorants; Flame Retardant Products, Short Chain Chlorinated Paraffins, Heavy Metals, Organotin Compounds, PFCs, Phthalates, Solvents.

¹⁰ <http://www.benettongroup.com/sustainability/detox/wet-process/water-test-results/>

¹¹ <http://www.benettongroup.com/sustainability/detox/wet-process/ipe-disclosure/>

Additional Background Information

Laboratories

All samples were tested in globally recognized ISO 17025 testing laboratories.

Test Methods

- Raw Materials and Products:
ALKYLPHENOLS: EN ISO 21084; EN ISO 18218 - 2 (leather)
ALKYLPHENOLS ETHOXYLATES: EN ISO 18254; EN ISO 18218 - 2 (leather)
- Wastewater:
ALKYLPHENOLS: ISO 18857-2 or ASTM D7065
ALKYLPHENOLS ETHOXYLATES: ISO 18254-1, ISO 18857-2 or ASTM D7065

Detection Limits *

- Raw Materials and Products:
PP/HP/NP/OP/NPEs/OPEs: 3 ppm
BP: 100 ppm **
- Wastewater: 5 µg/L (ppb)

*best reproducible detection limits currently achievable by all testing laboratories

**new additional compounds; high limits must be granted in consideration of the initial investigation stage

List of Alkylphenols + Alkylphenols Ethoxylates *

Name	CAS-Nr.	Abbreviation
4-tert-butylphenol	98-54-4	BP
Pentylphenol	80-46-6	PP
Heptylphenol	Various	HP
Octylphenol	Various	OP
Octylphenol ethoxylates	Various	OPEs [1 - 20]
Nonylphenol	Various	NP
Nonylphenol ethoxylates	Various	NPEs [1 - 20]

* Branched and linear alkyl chain