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# Benetton Group srl

# 2022 Wastewater Analysis

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## Introduction

Textile industry is linked to water pollution due to the large use of chemicals in its production processes. All 'textile wet processing', that include dyeing, washing, printing and fabric finishing, lead to the discharge of large quantities of wastewater containing toxic substances, many of which are hazardous and persistent. With the aim of "cleaning" the whole textile supply chain (i.e., clean factory approach), starting from 2013 Benetton collaborates with Greenpeace through the Detox Campaign[1] towards the complete elimination of hazardous chemicals from manufacturing and it has defined a Detox Programme Guideline, addressed to all its wet process suppliers.
In line with its Detox Commitment, Benetton Group joined two organizations: *Zero Discharge of Hazardous Chemicals* (ZDHC)[2] Group and *Sustainable Apparel Coalition* (SAC)[3], where international brands cooperate to improve the environmental performance of the supply chain and to develop methodologies to minimize and eliminate hazardous chemicals from textile production.
Tools and methodologies of both organization, as for example ZDHC Wastewater Guideline and Higg Facility Environmental Module (Higg FEM), are included in the Benetton's Detox Programme Guideline.

ZDHC Wastewater Guideline was released at the end of 2016 but, even if Benetton started adopting it from 2017, only in the last two years it was possible to collect a significant sample of test results. This was mainly due to the fact that the release and the finalization of the ZDHC Gateway took some time, not only for technical issues but also to allow time for suppliers' awareness of the importance to test following a standardized protocol, as well as sharing their wastewater test results within a shared portal.
In particular, from the ZDHC Gateway – Wastewater Module, it is possible to download all test results in a common excel format and then compare and analyze all reported data.

The ZDHC Wastewater Guidelines define a single, unified standard for wastewater testing that goes beyond regulatory compliance and conventional wastewater testing parameters and results are accepted by all ZDHC brands. According to this document, chemicals to be tested in wastewater are divided into two macro-groups, that are Conventional Parameters and MRSL Parameters. Conventional Parameters have to be tested in discharged wastewater while, concerning the MRSL Parameters, there are two testing options: discharged wastewater and sludge (Option 1) or discharged wastewater and raw wastewater (Option 2). Incoming water is tested only in case of findings, either in the discharged or in the raw wastewater.

In this report, data of wastewater analysis performed by Benetton's suppliers, have been analyzed by considering data disclosed in the ZDHC Gateway – Wastewater Module during the 2022 year, without distinguish among the testing options because, actually, this information is not "managed" in the excel file downloadable from the Gateway.

[1] Benetton's Detox Commitment: http://www.benettongroup.com/sites/all/temp/benetton_group_detox_commitment_1.pdf
[2] http://www.roadmaptozero.com/
[3] https://apparelcoalition.org/

## 2022 Wastewater Analysis

According to the data collected from the test reports published in the ZDHC Gateway – Wastewater Module during 2022, it emerges that 144 wet process suppliers working with Benetton and representing more than 80% in terms of volume (pcs produced by year), have performed wastewater analysis according to the ZDHC Wastewater Guideline, by following either option 1 or option 2.
As shown in figure 1, around 60% of these plants are in Asia (mainly in Bangladesh, China and India) and 40% in the Mediterranean Area (mainly in Italy and Turkey).

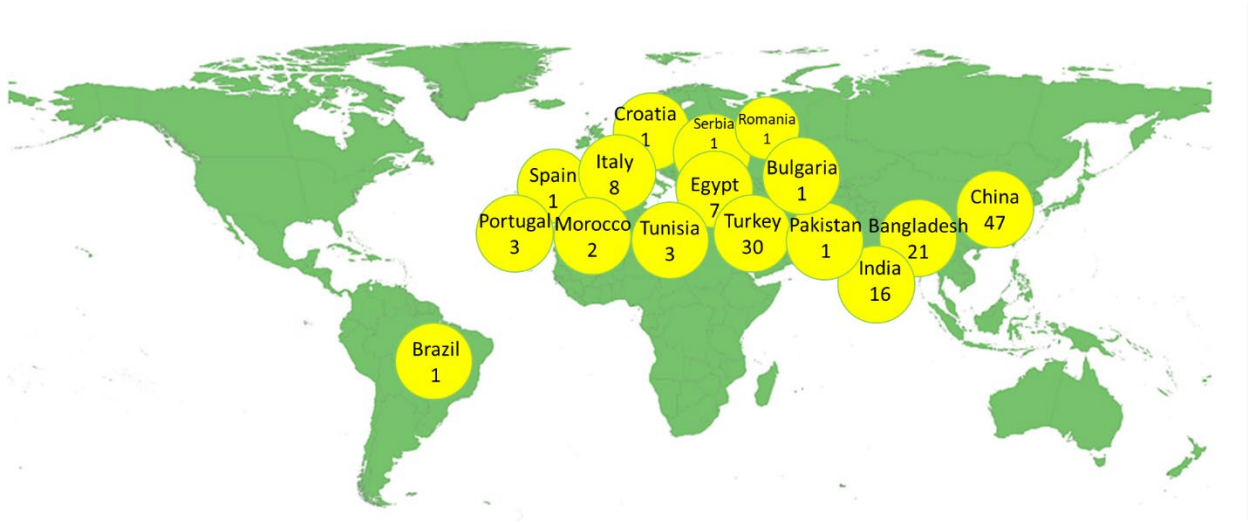


Figure 1 Country distribution

The collected data refer to facilities having different types of Effluent Treatment Plant (ETP) such as direct discharge (i.e., 40 facilities), indirect discharge (i.e., 97 facilities) and zero liquid discharge (i.e., 7 facilities). Some of them made only one test during the current year, some others more than one, and among these, there are also facilities that made one test by following option 1 and one test following option 2 (or vice versa). This implies that is quite difficult, if not impossible, to perform a good analysis since there is not an aligned set of data.
As a whole, it emerges that all facilities are very close to be totally in line with ZDHC requirements, showing an overall compliance (average value) of about 98%. Figure 2 shows the compliance percentage of all substance groups in three sampling points.

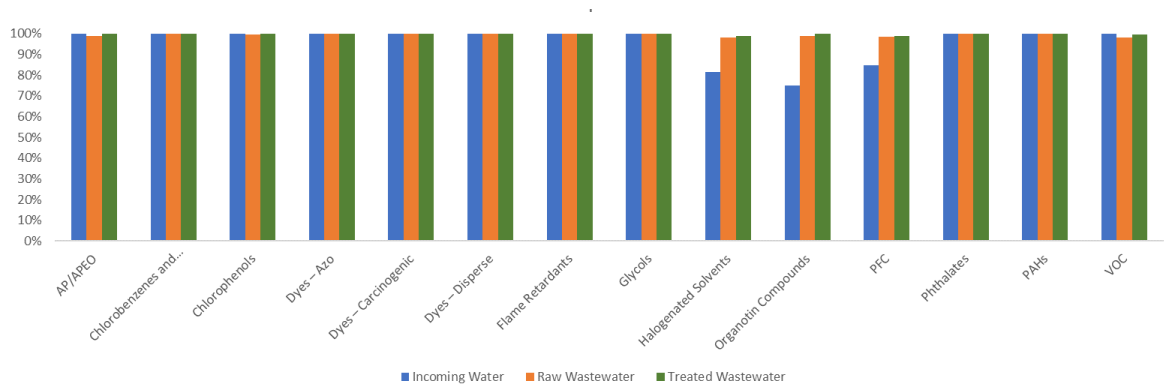


Figure 2 Compliance's Percentage.

It clearly occurs that Incoming Water is often already polluted, meaning that the possibility of finding contaminations in wastewater is very high. In particular, Organotin Compounds, Halogenated Solvents and PFCs are the main substance groups we can find in the Incoming Water. All other chemical groups are totally compliance with ZDHC MRSL and there are not any detection in Incoming Water.
It is important to note that in the ZDHC Wastewater Guideline sampling and testing of Incoming Water is not a requirement since it could be part of the root cause analysis when there is non-conformities in the MRSL parameters' tests. This imply that the number of tests performed in 2022 in Incoming Water is much lower than those made in the Raw and in the Treated Wastewater because there are still some suppliers asking for sampling and testing Incoming Water at the same time of the other two samples. Therefore, having less test, the percentage of not compliance in Incoming Water is higher than that in the Raw and Treated Wastewater.

To have a better understanding of the chemical substances that is possible to find in discharged water of textile industries, we decided to perform the analysis by considering the classification of the chemical substances groups defined in the ZDHC Wastewater Guideline: MRSL Parameters, Heavy Metals, Anions and Conventional Parameters[4]. The first three groups refer to Incoming, Raw and Treated Wastewater respectively. The last group, instead, refers only to Treated Wastewater of facilities with Direct Discharge.

## 1. MRSL Parameters

According to ZDHC Wastewater Guideline's classification, MRSL Parameters is constituted by the following Chemical Groups: AP/APEO, Chlorobenzenes and Chlorotoluenes, Chlorophenols, Dyes – Azo, Dyes – Carcinogenic, Dyes – Disperse, Flame Retardants, Glycols, Halogenated Solvents, Organotin Compounds, PFC, Phthalates, PAHs, VOC. All these groups have been tested either in the Raw or Treated Wastewater and, as root cause analysis, in the Incoming Water according to the methods described in the ZDHC WW Guideline[5].
In total, concerning MRSL parameters, 64,476 analytes have been tested and results show that only 179 (less than 0.5%) have been detected (both below and above ZDHC Limits). Therefore, we can conclude that, in general, facilities are very close to the total compliance of MRSL Parameters.

### Alkylphenols and Alkylphenols Ethoxylates (AP/APEO)

Alkylphenols and Alkylphenols Ethoxylates (AP/APEO) have been detected both in Raw and in Treated Wastewater.
The total number of AP/APEO's analytes tested in the 144 facilities is 1,420 with 14 detections (mainly in the Raw Wastewater) and, among those, 11 exceed the ZDHC Limits.
Regarding non-conformities in Treated Wastewater, only an NP's detection has been found in a facility located in Brazil. By looking at the non-conformities in Raw Wastewater, instead, NP is the substance mainly detected and it has been found in facilities located in China, Egypt and Italy (figure 3).

[4] We use "Conventional Parameters" to refer to the Sum Parameters defined in the Appendix A of the ZDHC Wastewater Guideline v.1.1. In the ZDHC document, in fact, Conventional Parameters include Sum Parameters, Anions and Heavy Metals.

[5] As already mentioned in the previous paragraph, even if sampling and testing of Incoming Water is not a requirement in the ZDHC Wastewater Guideline, some facilities still do it at the same time of the Raw and Treated Wastewater sampling.

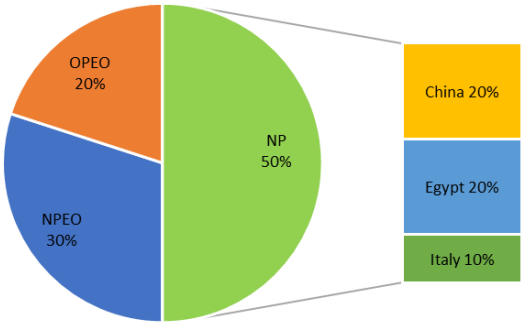


Figure 3 AP/APEO's non-conformities in Raw Wastewater.

## Chlorobenzenes and Chlorotoluenes

Chlorobenzenes and Chlorotoluenes have been detected in the Raw and in the Treated Wastewater. In total, 10,506 analytes have been tested with a percentage of detection (including non-conformities) of 0.11%. In fact, the number of detections-is 12: eleven have been found in the Raw Wastewater and one in the Treated Wastewater. Among these, 10 (nine in the Raw and one in the Treated Wastewater) are above the ZDHC Limit.

Figure 4 represents the non-conformities of Chlorobenzenes and Chlorotoluenes in Raw and Treated Wastewater: it emerges that all detections are below 0.03% and the main substances are 1,2,3,5-Tetrachlorobenzene, 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,3,5-Trichlorobenzene, 1,3-Dichlorobenzene, Monochlorobenzene.

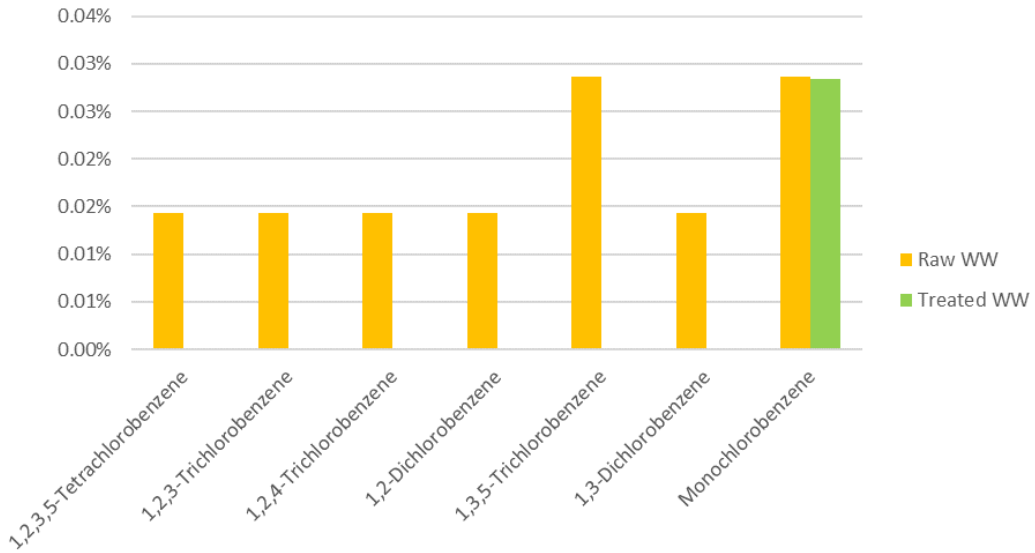


Figure 4 Chlorobenzenes and Chlorotoluenes non-conformities in Raw and Treated Wastewater.

All detections have been found in ten facilities located in China, Tunisia, Morocco, Bangladesh and Portugal.

## Chlorophenols

The total number of tested Chlorophenols is 6,728 with 13 non-conformities, all above ZDHC limit, detected in Raw Wastewater. Since each analyte exceeding the ZDHC limit represent less than 0.08% non-conformities (figure 5), these detections are considered impurities. Chlorophenols' detections belong to four facilities located in China, Turkey and Tunisia.

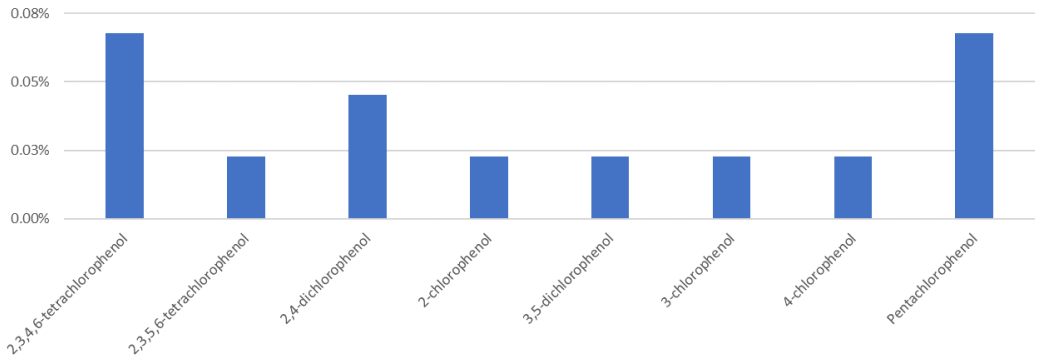


Figure 5 Chlorophenols' non-conformities in Raw Wastewater.

## Dyes – Azo

Among 19,433 tests performed on Colorants, Azo – Dyes (8,495 tested analytes) is the only substance group with some detections. From results, in fact, there is not any detection of Dyes – Carcinogenic (4,576 tested analytes) and Dyes – Disperse (6,372 tested analytes).

Non-conformities of Azo-Dyes represent 0.21% and 0.069% in Raw Wastewater and in Treated wastewater, respectively. Figure 6 shows detections in Raw and Treated wastewater: 4-chloroaniline is the substance with the highest number of detection (11 and 2 respectively), followed by 2-naphthylamine and 6-methoxy-m-toluidine.

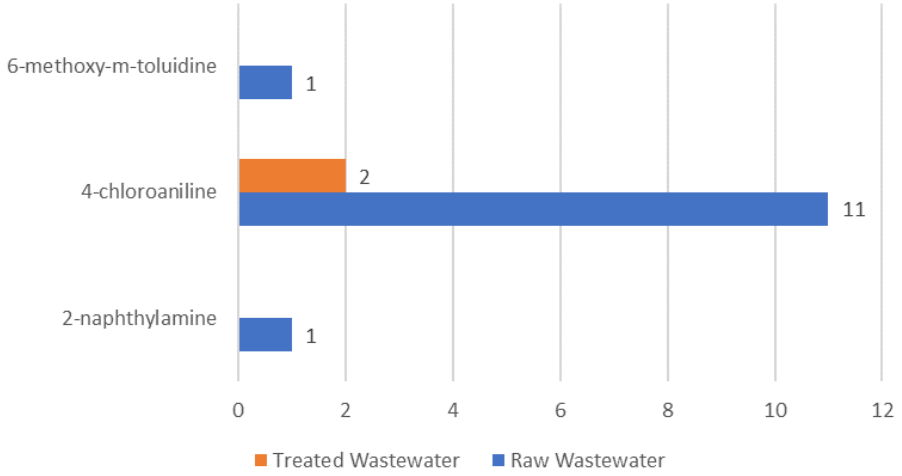


Figure 6 Number of Dyes-Azo detections in Raw Wastewater.

All detections, both in Raw Wastewater and in Treated Wastewater, have been found in facilities located in China, Italy and Turkey.

## Halogenated Solvents

Halogenated Solvents is one of the substances groups already present in the Incoming Water, especially in Italy (Methylene chloride), Tunisia (Tetrachloroethylene), Romania (Tetrachloroethylene), China (Methylene chloride). In total, 1,443 analytes have been tested: 27 in Incoming Water, 932 in Raw Wastewater and 484 in Treated Wastewater. The 29 detections are all above ZDHC limit: 18 in Raw Wastewater, 6 in Treated Wastewater and 5 in Incoming Water. Tetrachloroethylene, Methylene chloride, 1,2-dichloroethane and Trichloroethylene are the four halogenated solvents detected: as shown in figure 7 they are all present in raw wastewater, while Tetrachloroethylene and Methylene chloride have been detected in the Incoming water and in the Treated Wastewater too.

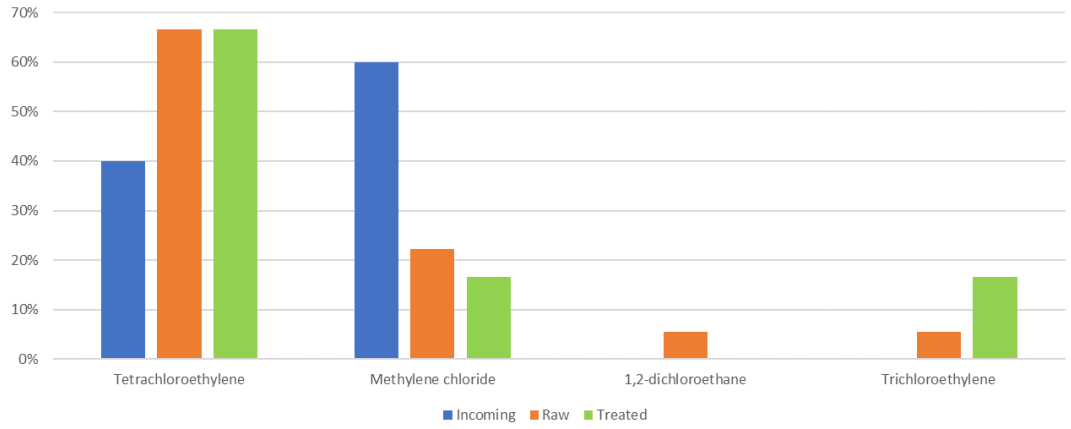


Figure 7 Halogenated Solvents non-conformities.

Regarding detection in Raw Wastewater, it emerges that the biggest pollution is in China and Italy, followed by Romania Tunisia, Morocco and Bulgaria (figure 8).

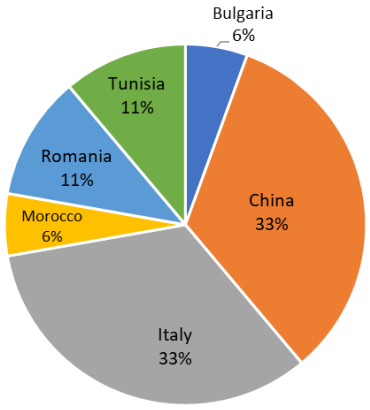


Figure 8 Halogenated Solvents' detection in Raw Wastewater by Country.

## Organotin Compounds

Organotin Compounds is one of the substance groups with non-conformities in Incoming Water. The results of 1,417 tests show that the biggest no compliance is in the Raw Wastewater (12 detections over 931 tested analytes). Only 4 tests have been made in the Incoming Water with 1 detection: this means Incoming water has been analyzed only for a Root Cause Analysis of some facilities. No detections have been found in Treated Wastewater (482 tested analytes). Figure 9 shows the number of detections in the sampling points.

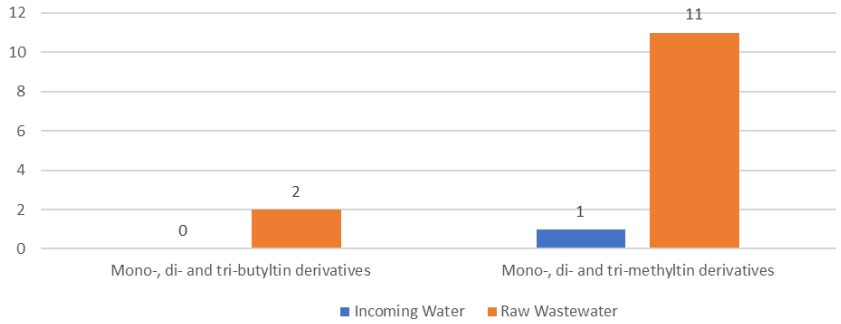


Figure 9 Number of Organotin Compounds' detections.

The total number of facilities with Organotin detections is 11 and they are mainly located in China (93% of detections).

## Perfluorinated and Polyfluorinated Chemicals (PFCs)

PFCs is the group with the highest percentage of detection.): among 2,150 PFCs tested, only 33 detections, all above the limit, have been found. In particular, the highest percentage of failures is in the Incoming Water (15% non-compliance), meaning that traces found in both Raw Wastewater (1.5% non-compliance) and Treated Wastewater (2.26% non-compliance) could be affected by the incoming impurities[6] (figure 10).

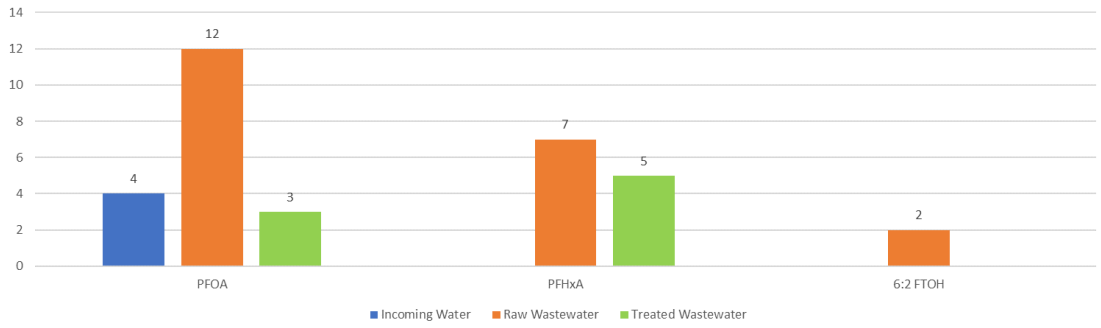


Figure 10 Number of PFCs' detections.

Most of detections have been found in China: 89% of PFOA, 75% of PFHxA and 100% of 8:2 FTOH. Chinese facilities are the only with detections in all three sampling points.

## Phthalates

The total number of tested analytes belonging to Phthalates is 5,729 and percentage of non-compliance is 0.16%in the Raw Wastewater. This means that Phthalates are almost not present in the process. Among Phthalates analytes (i.e., 16 analytes), in fact, onlyDi(ethylhexyl) phthalate (DEHP), Dibutyl phthalate (DBP), Diethyl phthalate (DEP), Di-isobutyl phthalate (DIBP), Di-isononyl phthalate (DINP), have been detected for a total of 13 findings (figure 11).

[6] Taking into account that Incoming Water is the sampling with less number of tested performed.

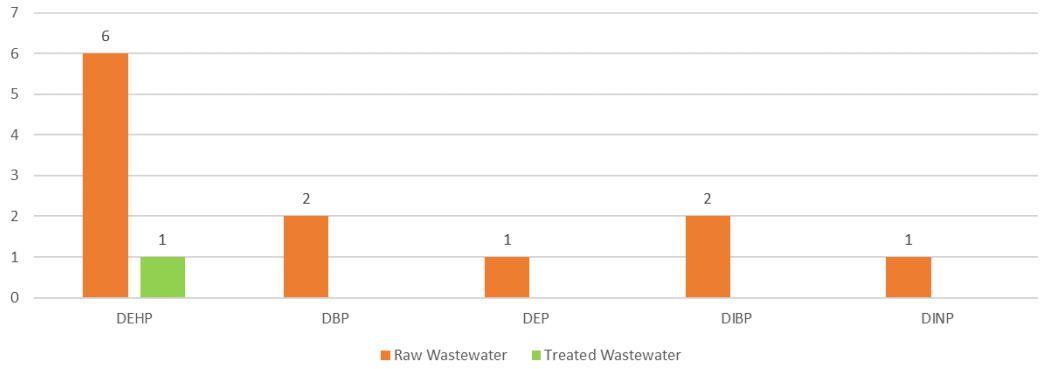


Figure 11 Number of Phthalates' detections.

The total number of facilities with Phthalates' detections is 7 and three of them are located in China, while the other four facilities are located in Italy, Egypt, Serbia and Turkey.

## Polycyclic Aromatic Hydrocarbons (PAHs)

The total number of tested Polycyclic Aromatic Hydrocarbons (PAHs) analytes is 6,386 with 9 detections in Raw Wastewater. The detected analytes are Naphthalene, Pyrene, Fluoranthene and Phenanthrene (figure 12) and they have been found in 4 facilities, two located in Italy, one in Bulgaria and one in Turkey.

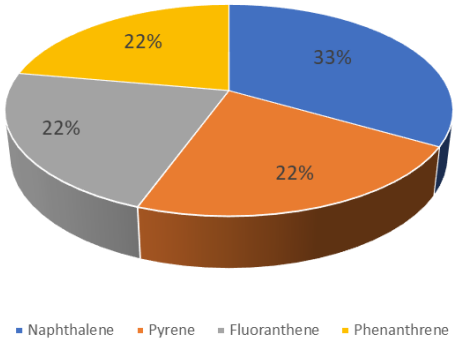


Figure 12 Detections in Raw Wastewater.

## VOC

The total number of tested analytes within the VOC's group is 1,832 with only 23 detections, mainly in Raw Wastewater, all above the ZDHC Limit of 1 µg/l, except of one. All detections in the Treated Wastewater exceed the ZDHC Limit (figure 13).

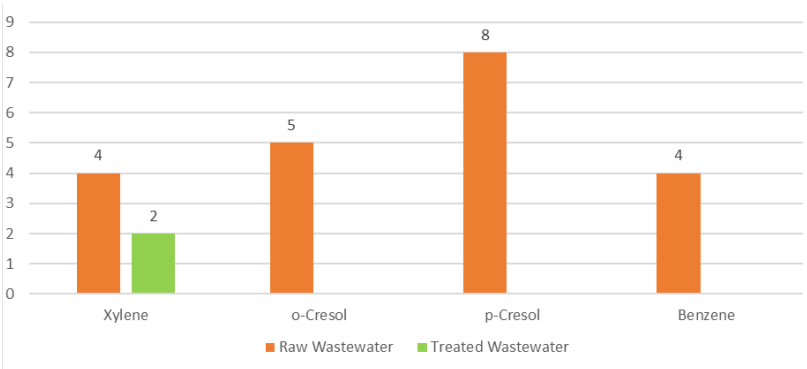


Figure 13 Number of VOC's detections.

The 23 detections of VOC have been found in five facilities located in China, four in Italy, three in Turkey, one in Tunisia, Croatia, Serbia, Egypt. All facilities have VOC in Raw Wastewater except the Italian and Tunisian ones which have VOC in the Treated Wastewater too.

## 2. HEAVY METALS

Heavy Metals group has been analyzed in Incoming Water, Raw Wastewater and Treated Wastewater with 4,732 tested analytes. In particular, by looking at the Incoming Water, results show that it is already polluted (figure 14): major detections have been found for Zinc, Copper, Nickel, Mercury and Antimony, followed by Arsenic, Chromium total, Cadmium and Lead, while there are no detections (or close to null) of Chromium (VI), Cobalt and Silver.

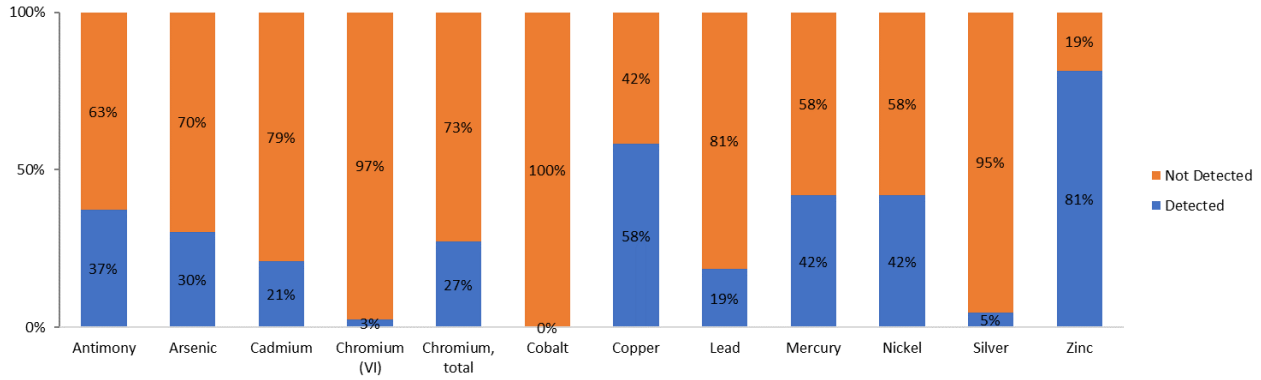


Figure 14 Heavy Metals' detections in Incoming Water.

As shown in figure 15, detections have been found mainly in China (76%). Italy, Turkey and Romania account, respectively, for 9%, 7% , and 4% and the remaining 4% is represented by detections in Bulgaria, Croatia, Egypt and Serbia. In particular, Cadmium and Silver's detections have been found in China and the only Chromium (VI)'s detection has been found in Italy.

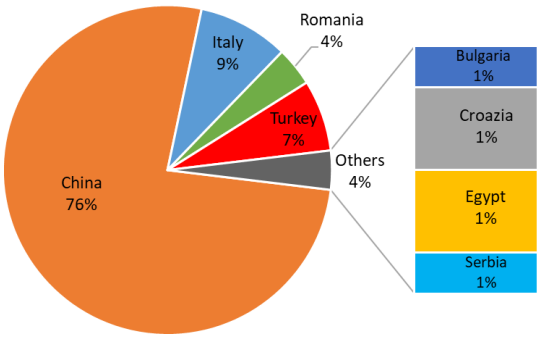


Figure 15 Heavy Metals' detections in Incoming Water by countries.

By looking at the number of detections (both in the Raw Wastewater and in the Treated Wastewater) by Country, China is the one with the highest value with 47.81% of the total detections. It is followed by Turkey (17.08%), Bangladesh, India, Italy and Egypt (with values between 2% and 10%), while other countries (Brazil, Portugal, Spain, Morocco, Romania, Croatia, Bulgaria, Serbia and Tunisia) have detections for less than 2%. Moreover, in China, all metals have been detected both in Raw Wastewater and in Treated Wastewater, including Chromium VI, Mercury, Cobalt and Silver that are those with the lowest number of detection (11% of the total). Traces of these metals have been found also in Egypt, India, Italy, Thailand and Turkey and in

most of the cases, there is not any detection in the Treated Wastewater. Figure 16 represents detections of Antimony, Arsenic, Chromium total, Copper, Lead, Nickel and Zinc by Country.


Figure 16 Main Heavy Metals' detection in Raw Wastewater (RW) and Treated Wastewater (TW) by Country.

## 3. ANIONS

The group of Anions is constituted by Cyanide, Sulfide and Sulfite and the total number of tests performed in the three sampling points is 710 of which only 9 in the Incoming Water.
By looking at the presence of Anions in Raw Wastewater by country, it emerges that they refer to two suppliers, one in China and one in Tunisia. Regarding Treated Wastewater, instead, suppliers with detections are in Bangladesh (18 facilities), China (3 facilities) and Turkey (4 facilities).

## 4. CONVENTIONAL PARAMETERS

As already noted, in this work Conventional Parameters refer to the Sum Parameters defined in Appendix A of the ZDHC Wastewater Guideline v.1.1. In this section results of tests made in facilities having direct discharge (i.e. having an own ETP) are analyzed.
These parameters, in fact, mostly refer to the proper functioning of an ETP and they can be briefly summarized in temperature, pH, biological oxygen demand (BOD5) or chemical oxygen demand (COD), that's the reason why it has no sense to test them in wastewater before treatment, unless supplier uses a centralized effluent treatment plant (CETP). In this specific case, these parameters should be compliant with the legal discharge permit and/or receiving CETP limits that could be different from ZDHC requirements.
In 2022, facilities with direct discharge represent more or less 30% of the wet process suppliers working with Benetton and the total number of tests performed is1314 and the main detection are in the Treated Wastewater (figure 17).

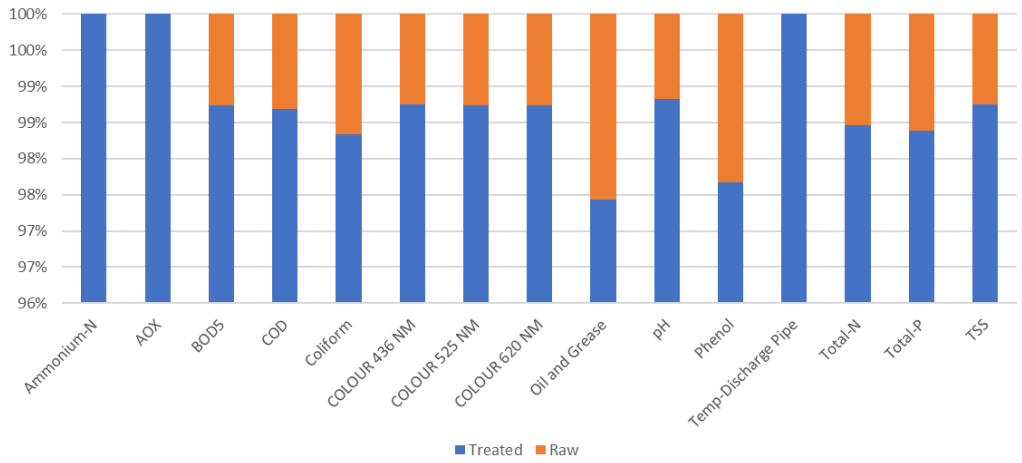


Figure 17 Conventional Parameters' Detection.

Concerning detections by Country, they refer to facilities located in Bangladesh (60% of total detections), China, India, Pakistan, Portugal, Tunisia and Turkey.

## Conclusion

Textiles industry is one of the major users of hazardous chemicals and industrial polluter of freshwater but since the beginning of the Greenpeace Detox campaign (in 2011), many progresses have been reached even if the goal of the total elimination of the hazardous chemicals has not been accomplished yet.

From our results, in fact, it emerges that some hazardous chemicals are still present in discharged water, and this could be associated either with the already presence in the incoming water or with the use of those substances in the process, meaning that the Chemical Inventories of the suppliers are not fully aligned with the ZDHC parameters yet. It has to be noted that, to be truthful, the presence of some substances very low detected could probably derive from impurities in chemicals or commodities.

Independently from the obtained results in 2022, Benetton will continue encouraging its suppliers to achieve a cleaner production and it will enforce the control on the suppliers input chemicals management. Moreover, together with other brands, Benetton will continue enhancing the visibility of ZDHC and SAC tools to improve the supply-chain performance and to analyze the results as a “global” industry.