



Benetton Group srl
2025 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 Campaign¹ 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 Cascale³, 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 organizations, 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 four 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 three macro-groups, that are MRSL, Heavy Metals and Conventional Parameters and Anions.

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 2024 year.

All the tests have been performed according to ZDHC Wastewater Guideline V 2.2.

¹ Benetton's Detox Commitment available at: <https://www.benettongroup.com/en/sustainability/nature/water/detox/>

² <http://www.roadmaptozero.com/>

³ <https://cascale.org/>

2025 Wastewater Analysis

According to the data collected from the test reports published in the ZDHC Gateway – Wastewater Module during 2025, it emerges that 140 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.

As shown in Figure 1, around 85% of these plants are in Asia (mainly in Bangladesh, China and India) and 15% in the Mediterranean Area (mainly in Italy, Egypt and Turkey).

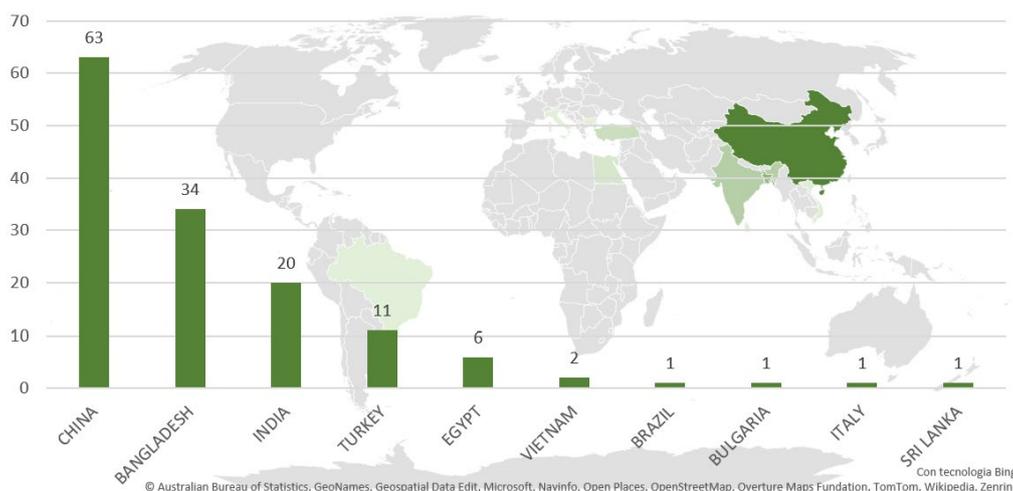


Figure 1 Country distribution

The collected data refer to facilities having different types of Effluent Treatment Plant (ETP) such as direct discharge (i.e., 48 facilities), indirect discharge (i.e., 85 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: this implies that it is quite difficult to perform a good analysis since there is not an aligned set of data.

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 are non-conformities in the MRSL parameters' tests.

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 Guideline⁴: MRSL Parameters, Heavy Metals, Anions and Conventional Parameters.

1. MRSL Parameters

According to ZDHC Wastewater Guideline's classification, MRSL Parameters is constituted by the following Chemical Groups: AP/APEO, Anti-Microbials & Biocides, Chlorinated Parafins, Chlorobenzenes and Chlorotoluenes, Chlorophenols, N,N-di-methylformamide (DMFa), Dyes – Carcinogenic, Dyes – Disperse, Dyes - Navy Blue Colourant, Flame Retardants, Glycols/Glycols Ethers, Halogenated Solvents, Organotin Compounds, Other/ Miscellaneous Chemicals, Perfluorinated and Polyfluorinated Chemicals (PFCs), Phthalates, Polycyclic Aromatic Hydrocarbons (PAHs), Restricted Aromatic Amines (Cleavable from Azo-

⁴ ZDHC Wastewater Guideline are available at: <https://www.roadmaptozero.com/output>

colourants), UV Absorbers, Volatile Organic Compounds (VOC). All these groups have been tested in the Untreated Wastewater according to the methods described in the ZDHC WW Guideline.

In total, concerning MRSL parameters, 54,569 analytes have been tested in the Untreated Wastewater and results show that only 128 (around 0.2%) have been detected (both below and above ZDHC Limits). No any detection has been found in Anti- Microbials & Biocides, Dyes – Carcinogenic or Equivalent Concern, Dyes – Disperse (Allergenic), Glycols and UV absorbers in the Untreated wastewater.

For those exceeding the ZDHC limits, compliance is shown graphically in Figure 2. Therefore, we can conclude that, in general, facilities are very close to the total compliance of MRSL Parameters.

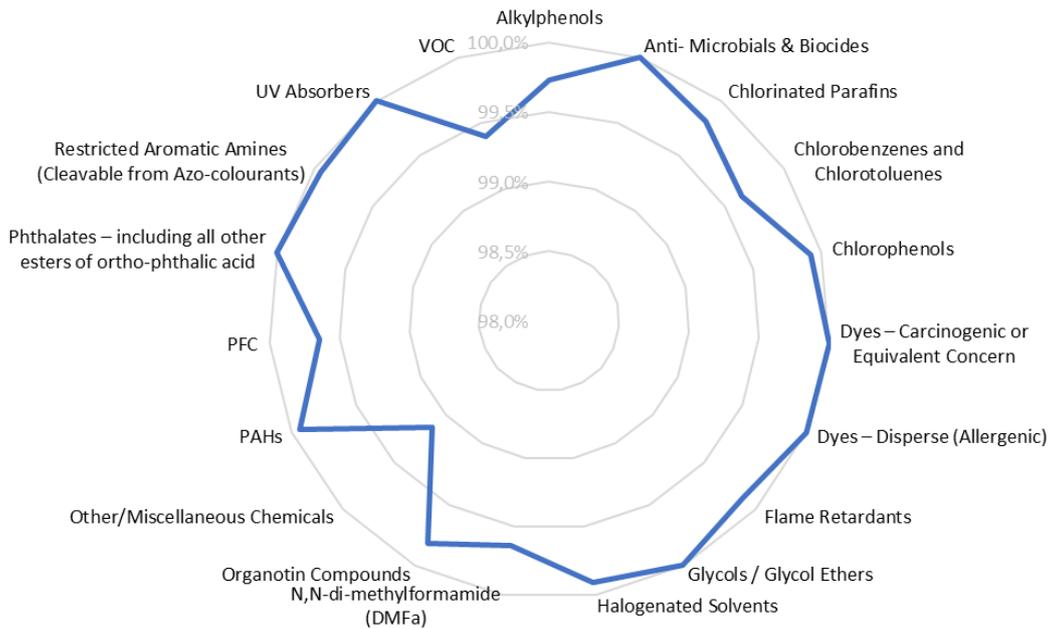


Figure 2 Compliance of ZDHC MRSL Parameters in untreated wastewater

Alkylphenols and Alkylphenols Ethoxylates (AP/APEO)

Among the 1,108 Alkylphenols and Alkylphenols Ethoxylates (AP/APEO) tested, only three detections have been found: one *Nonylphenol (NP)*, *mixed isomers* and two *Nonylphenol ethoxylates (NPEO)* that exceeded the ZDHC Limits.

Chlorinated Parafins

Among the 554 Chlorinated Parafins tested, only one detection (Short-chain Chlorinated Paraffins (SCCPs)) has been found in a Chinese facility. The value exceeds ZDHC Limits.

Chlorobenzenes and Chlorotoluenes

Two Chlorobenzenes and Chlorotoluenes (1,2-dichlorobenzene Other isomers of mono-, di-, tri-, tetra-, penta- and hexa- and the Chlorobenzene and mono-, di-, tri-, tetra- and penta- chlorotoluene) have been detected in the Untreated Wastewater of a Bangladesh facility.

Chlorophenols

The total number of tested Chlorophenols is 5,263 with 5 detected analytes in one facility located in Bulgaria. As shown in Figure 3, four of them do not meet requirements. The total number of compliant Chlorophenol analytes is 5,259, meaning more than 99% compliance.

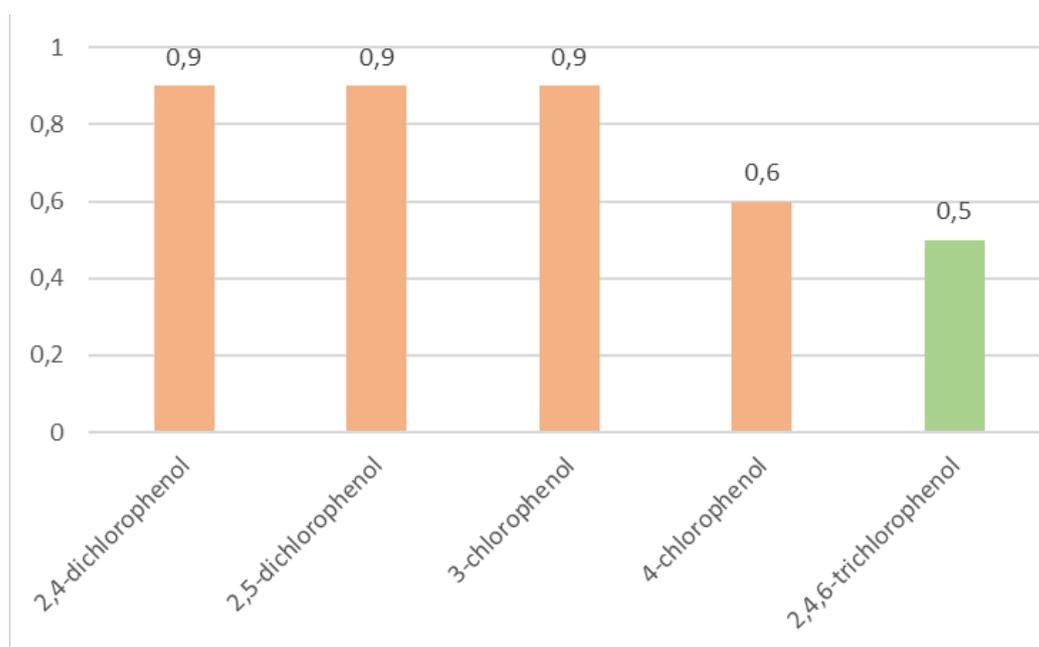


Figure 3 Number of Chlorophenols' detections

Flame Retardants

The total number of analytes tested is 8,310 with 30 detections and, among those, only 10 do not meet requirements. Detections have been found in China (3 facilities) and in Turkey (3 facilities): those exceeding ZDHC limits belong to two Turkish facilities (see figure 4, Turkey 3 and Turkey 4 facility).

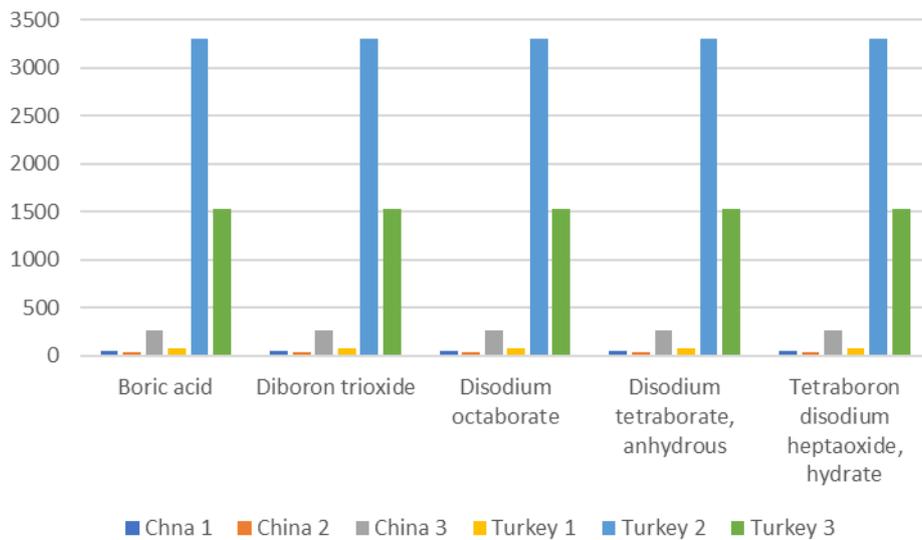


Figure 4 Flame Retardants detections

Halogenated Solvents

In total, 1,108 analytes have been tested, with 1 detection that does not meet requirements. The analyte detected is the Methylene chloride and it has been found in a facility located in China.

Organotin Compounds

The results of 2,770 tests on Organotin Compounds show that there are 5 detections and are all above the ZDHC limits. Detections refer to the same analyte, i.e. Mono-, di- and tri-methyltin derivatives, found in 5 facilities located in China (Figure 5).

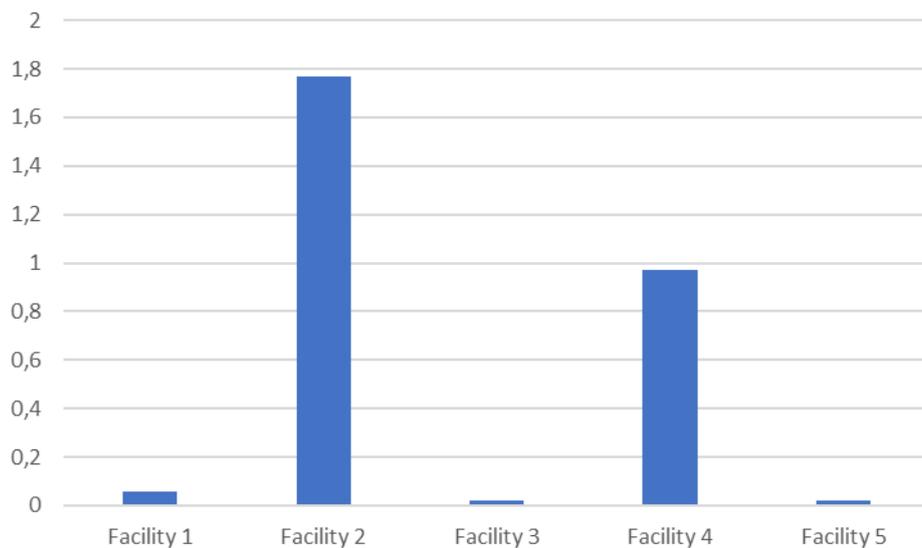


Figure 5 Mono-, di- and tri-methyltin derivatives detections

Other/Miscellaneous Chemicals

Regarding other/miscellaneous chemicals, a total of 1,385 tests were performed, with a compliance of 99.1% (1.373 meet requirements). From these tests, 53 detections of Borate, Zinc Salt were identified, but only 12 of them do not meet ZDHC Requirements. Those exceeding limits have been found in facilities located in Bulgaria (1 facility), China (6 facilities), Italy (1 facility) and Turkey (3). The other detections belong to facilities located in Bangladesh and Vietnam.

Polycyclic Aromatic Hydrocarbons (PAHs)

The total number of tested Polycyclic Aromatic Hydrocarbons (PAHs) analytes is 4,986 with 6 detections of Naphthalene. Among these 6 detections, belonging to facilities located in Bulgaria, China, Italy and Turkey, 3 of them do not meet the requirement for ZDHC (Figure 6) and they are in China and Turkey.

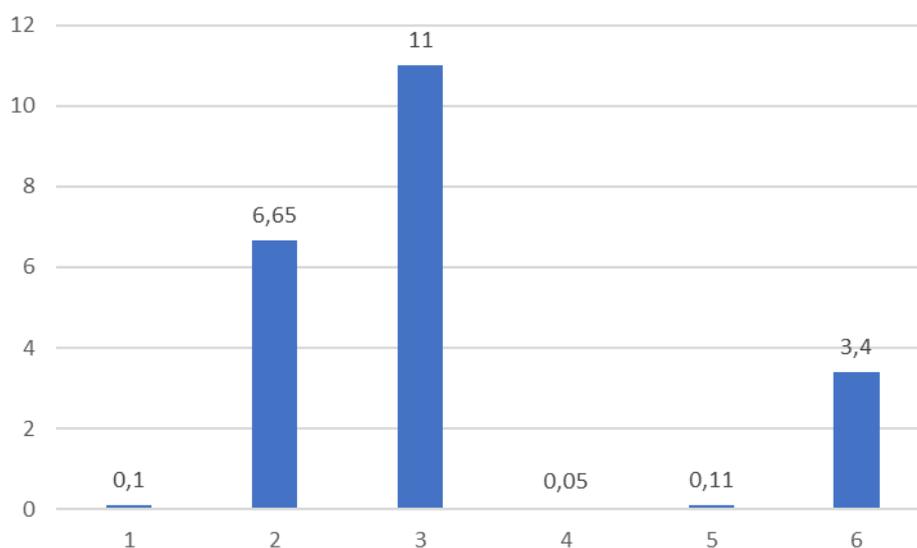


Figure 6 PAHs detections

Perfluorinated and Polyfluorinated Chemicals (PFCs)

Among 554 PFCs tested compounds, 4 detections have been found in Bulgaria and Italy. The 2 exceeding ZDHC limit are Perfluorooctane sulfonate (PFOS) and related substances and come from the facility located in Bulgaria. In Italy, Perfluorooctanoic acid (PFOA) related substances have been found within the limits.

Phthalates

The total number of tested analytes belonging to Phthalates is 4,986 with only one detection of Di-isobutyl phthalate (DIBP) in Bulgaria within the limits. This means the total compliance is 100%.

Restricted Aromatic Amines (Cleavable from Azo-colourants)

On 7,756 test restricted aromatic amines analytes, only 4 detections have been found and all of them are above ZDHC limits. Figure 7 shows detection of 4-chloroaniline and 4,4-methylenedianiline in one facility located in Bulgaria, one in China and two in Turkey.

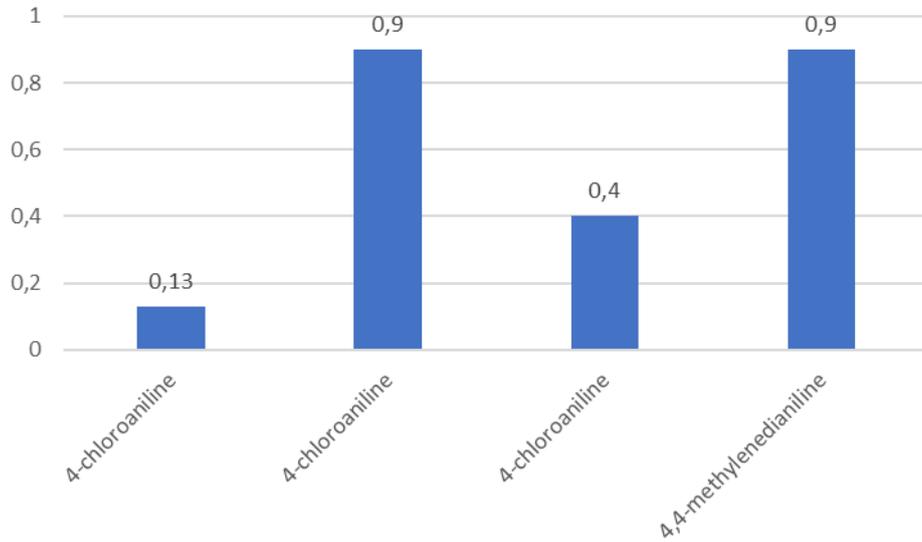


Figure 7 Restricted Aromatic Amines detections

Volatile Organic Compounds (VOC)

The total number of tested analytes within the VOC's group is 1,662 with 12 detections in Untreated Wastewater, 10 of them do not meet the ZDHC requirements (Figure 8). Detection have been found in Bulgaria, China, Egypt and Turkey.

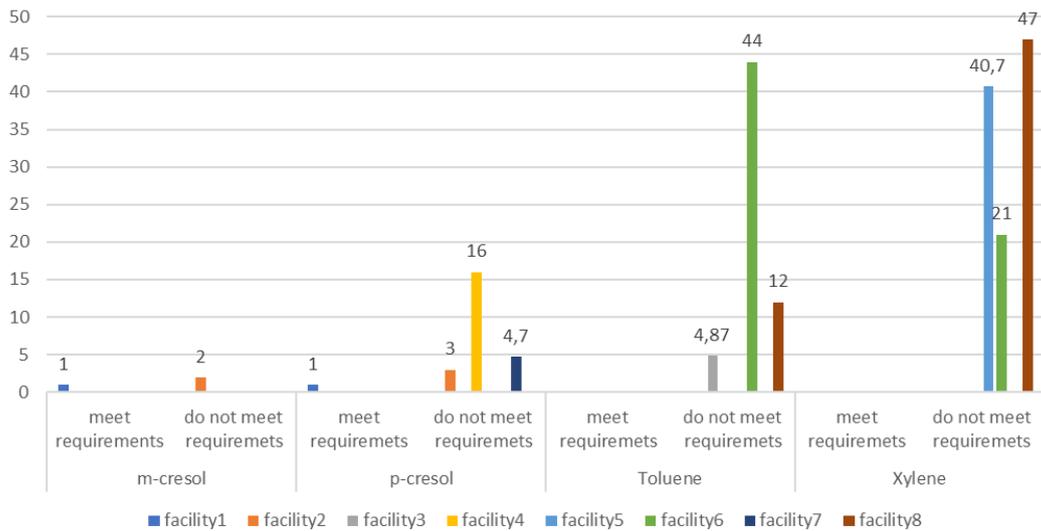


Figure 8 VOC's detections

2. HEAVY METALS

Heavy Metals group has been analyzed in Effluent Wastewater with 2,455 tested analytes, 115 detected (Figure 9). Major detections have been found for Barium, Arsenic, Zinc, Lead and Antimony, followed by Nickel (Ni), Copper (Cu), Chromium, total (Cr), Cobalt (Co), Selenium (Se), Cadmium (Cd), Chromium (VI) and Mercury (Hg). No any detection has been found for Silver (Ag) and Tin.

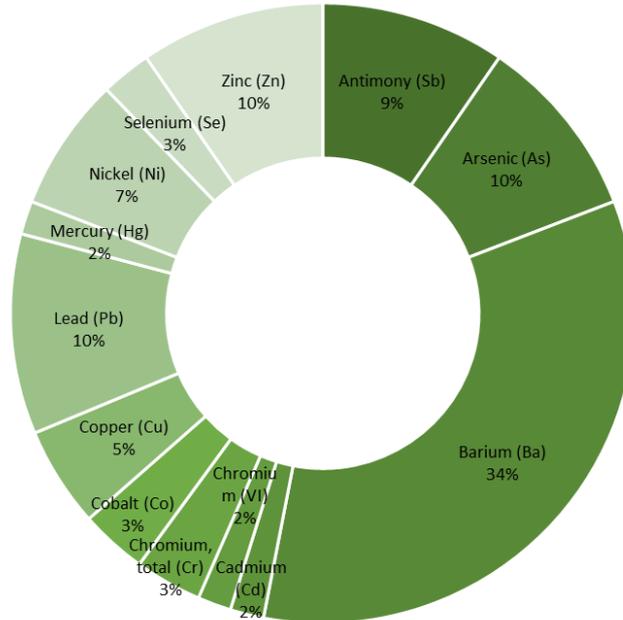


Figure 9 Number of Heavy Metals detections

Looking at the graph in the Figure 10, which shows the percentage of analytes that fall within the classification levels for ZDHC concentrations, it is noticeable that for the metals analyzed, almost the entire aspirational level has been reached. Only one value detected for Lead was exceeding the limit.

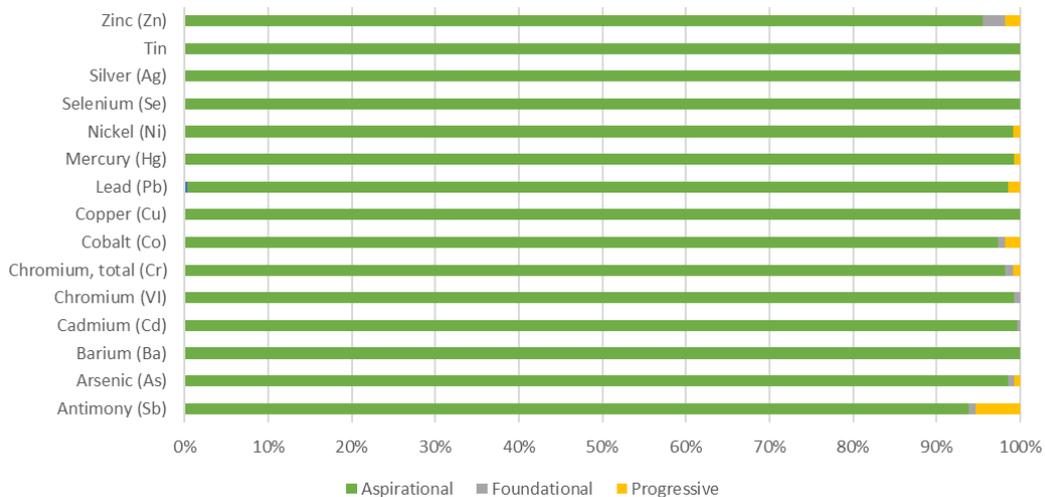


Figure 10 Percentage of Heavy Metals in ZDHC Limits

3. ANIONS

The group of Anions is constituted by Chloride, Cyanide, Sulfate, Sulfide and Sulfite and the total number of tests performed is 565 of which 300 have been detected (Figure 11).

Sulfate and Chloride are the most detected but as for the concentration ZDHC requires only the “sample and report”, in terms of quantity it is found Sulfite and Sulfide and the least detected is Cyanide.

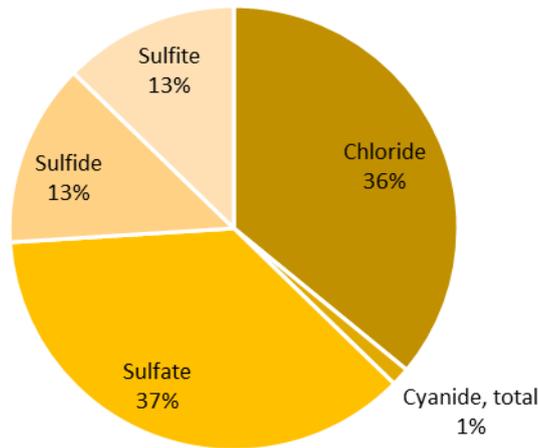


Figure 11 Percentage of Anions detected.

As mentioned above, concentration of Sulfate and Chloride are only sampled and reported, for Sulfite, Sulfide and Cyanide instead limits on concentration are classified in 3 levels as requested by ZDCH and in figure 12 are schematically reported.

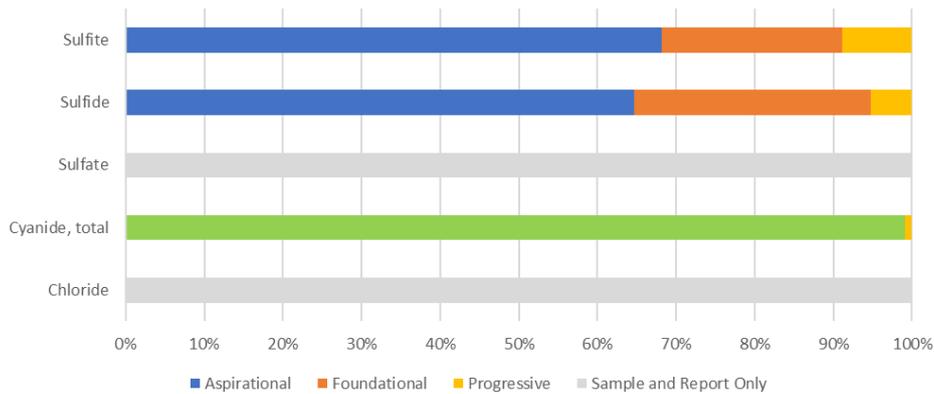


Figure 12 Percentage of Anions in ZDHC Limits

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.2.1. 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.

Figure 13 represents the percentage of parameters that have reached levels accordingly with the ZDHC guidelines. Wastewater flowrate and Total Dissolved Solids (TDS) are not reported in the chart since they have been only sampled and reported.

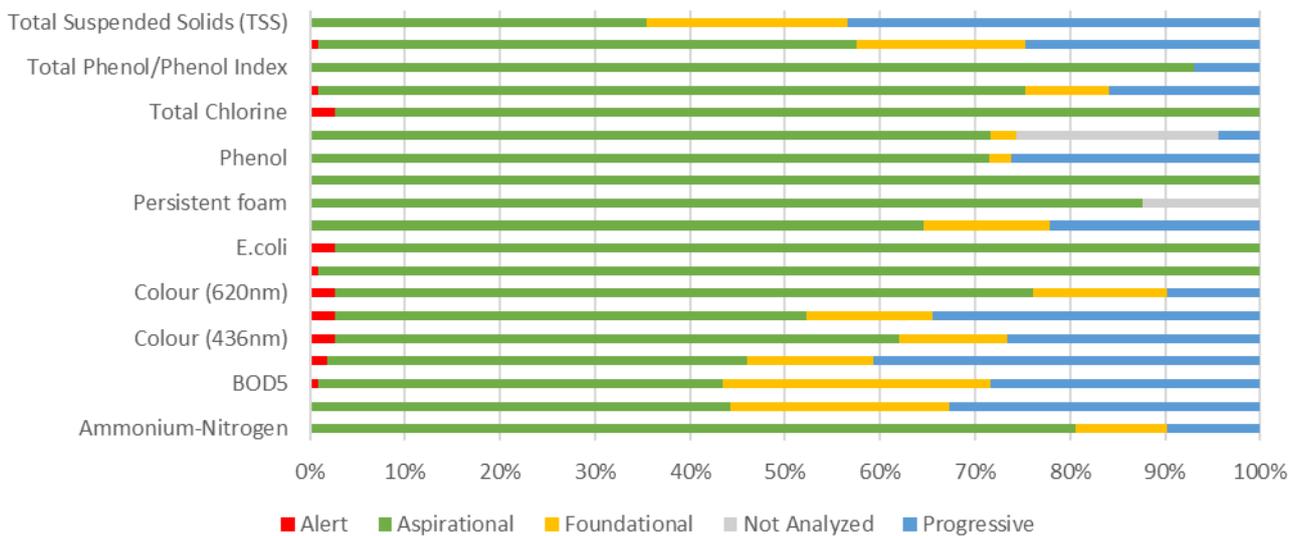


Figure 13 Percentage of Conventional Parameters in ZDHC Limits

For the majority of parameters analyzed more than 50% of the concentration have reached the aspirational limit. Only few parameters still present “alert” level since they exceed ZDHC Limits.

5. SLUDGE

As required by the ZDHC Wastewater Guidelines, suppliers must also test the sludge generated as a by-product of wastewater treatment processes. Wastewater treatment sludge is a necessary and unavoidable by-product of proper wastewater treatment. Inadequate sludge management can have a negative impact on human health and the environment.

Of all the parameters tested, not all were classified as “Meets Requirements” or “Does Not Meet Requirements” because the requirements change depending on the type of discharge from the supplier's plant and the different sludge disposal routes that the supplier chooses and declares to use, as indicated in the ZDHC Wastewater Guidelines.

A total of 5,709 parameters were tested in sludge for our value chain in 2025: 5,061 MRSL parameters, 274 Conventional parameters, 26 Anions and 350 Metals.

Among these tests, not all were subject to evaluation; in fact, for 80% of the tests, only "Sample and Report" was required. For all the others, compliance was nearly 100%, as there were only six detections that didn't meet ZDHC requirements for Heavy Metals and Conventional Parameters (Figure 14).

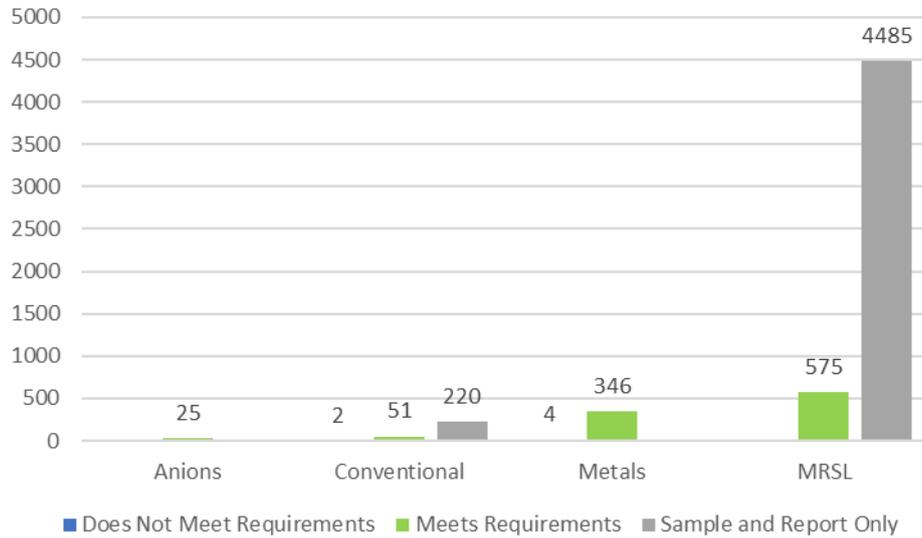


Figure 14 Number of Detection in Sludges

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 2025, 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 Cascale tools to improve the supply-chain performance and to analyze the results as a "global" industry.