ETAD
Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers

ETAD Information Notice on the occurrence of false positives in the aniline determination in dyes formulations via ISO 14362-1:2017

October 2026

1 Background

In recent years, method ISO 14362-1:2017, initially developed to detect only restricted aromatic amines in textiles, has increasingly been used for the determination of aniline as well, both in dye formulations and in end articles.

As corresponding findings accumulated, colorant manufacturers have become aware of false positive results related to this specific determination. This notice describes the origin of these false positives and provides recommendations to recognize and communicate them along the value chain, in order to avoid an unfounded negative impact on commercial products.

2 Method details

The standard method EN/ISO 14362-1:2017 is the reference for the determination of carcinogenic aromatic amines in textiles as possible cleavage products from azo dyes, in particular to prove regulatory compliance to Annex XVII, Entry 43[1] of EU REACH. In similar forms, this requirement is also part of several national regulatory frameworks as well as of all voluntary textile standards, where it translates into a component of the overall RSL compliance. The same method is also used, in an adapted form, for the determination of aromatic amines directly in dye samples, particularly in the framework of voluntary standards[2, 3, 4].

The principle of the method is the use of sodium dithionite as reductive agent to cleave the azo bond in the dyes, thus mimicking the potential metabolism through skin biota of dyes accessible in dyed garments. For aniline, depending on the requirements, the reduction step can be skipped ("free aniline" determination) or kept ("free and cleavable aniline" or "total aniline" determination).

Since **sodium dithionite is a strong reductive agent,** depending on the structure of the tested molecule, other groups than the targeted azo bond can be reduced. Additionally, sodium dithionite can further react with the products of the reductive cleavage. Consequently, both these processes can produce aromatic amines which are outside the scope of the test and will create false positive results.

Known examples of these cases are mentioned in Annex C of ISO 14362-1:2017, which recommends appropriate procedures to check the reliability of the obtained results. **Annex C, however, only refers to false positives related to the originally targeted restricted amines,** i.e., it does not consider any cases related to the determination of aniline.

[1] https://reach-info.ineris.fr/sites/snar-reach/files/pdf/annexe_xvii_2023_en.pdf
[2] https://global-standards.org/images/downloads/standard-manual/global_organic_textile_standard_manual_v8.1_2026.pdf, section 7.2.3
[3] https://www.oeko-tex.com/fileadmin/user_upload/Marketing_Materialien/ECO_PASSPORT/Standard/OEKO-TEX_Testing_Methods_ECO_PASSPORT.pdf
[4] https://mrsl-30.roadmaptozero.com/?sword=aniline

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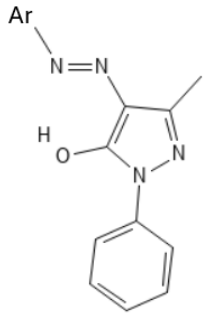
3 Evaluation of available data on aniline detection

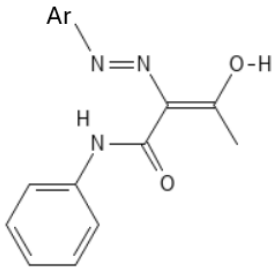
Several ETAD members reported that some colorants belonging to **two specific structural groups regularly appear to release high quantities of aniline, even though the molecule cannot be the result of reductive cleavage of the colorant's azo bond(s).** The possibility that aniline was present as impurity at the measured level was also excluded by measuring the free aniline content.

The two affected groups identified through the evaluation of analytic results are:

a) 1-phenyl-3-methyl-5-pyrazolone-derived dyes (PMP-derived dyes, see general structure below)



b) Acetoacetanilide-derived dyes (AAA-derived dyes, see general structure below)



To clarify these findings, ETAD companies confronted with this issue carried out internal measurements of the aniline content in the dye formulations with the ISO method, both with and without reductive cleavage. In some cases, the aniline content was also measured on dyed garments.

Representative results from these measurements are summarized in anonymized form in the table on the next page.

These analytical results show that:

- Even if, in some cases, the analysed dyes contained some free aniline (possibly as residue from the synthetic process), where a comparison was performed the reductive step clearly led to a noticeable increase in the measured aniline.
- This increase was highly variable, even for the same dye.
- When carried out, **the analysis of textile/leather dyed under standard and overdyeing conditions did not show problematic levels of aniline even after application of the method with reductive cleavage.**

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4 Origin of the false positives

For both dye groups, the assumed mechanism for the formation of aniline is a secondary reaction under the test conditions, which will release aniline from the phenylpyrazolone or acetoacetanilide moiety of the dyes' molecules.

In particular:

- Sodium dithionite is known to be able to reduce the phenylhydrazo group to aniline, which will affect PMP-derived dyes;
- With AAA-derived dyes, under the reaction conditions hydrolysis of the acetanilide moiety of the molecule can occur and will release aniline.
- Additionally, in the case of AAA-derived dyes, experimental results showed that the use of GC for the amine identification can lead to significantly higher values than when using HPLC. It is presumed that the high temperature in the GC apparatus can cause a thermal cleavage of the molecule or of its cleavage products and release aniline as a byproduct.

Affected dye	Determination without reductive cleavage (ppm)	Determination with reductive cleavage (ppm)	Findings on dyed fabric with reductive cleavage (ppm)
AAA-derived dye 1	25	89	
AAA-derived dye 2	139	580	n.d. by 3% o.w.f. dyeing
AAA-derived dye 3	86	345	n.d. by 3% o.w.f. dyeing
AAA-derived dye 4	44	81	n.d. by 3% o.w.f. dyeing
	44	90	14 ppm by 6% o.w.f. dyeing (leather)
	21-74	-	
	-	1891	
PMP-derived dye 1	n.d.	503	n.d. by 3% o.w.f. dyeing
PMP-derived dye 2	n.d.	60-200	
PMP-derived dye 3	<100	100-200	
PMP-derived dye 4	<50	200-500	
PMP-derived dye 5	n.d.	190	n.d. by 3% o.w.f. dyeing
PMP-derived dye 6	n.d.	100-1000	
PMP-derived dye 7	n.d.	551	n.d. by 3% o.w.f. dyeing
PMP-derived dye 8	n.d.	295	n.d. by 3% o.w.f. dyeing
PMP-derived dye 9	n.d.	152	n.d. by 3% o.w.f. dyeing

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5 Impact on commercial products

Products showing these false positive results are strongly affected, since they will not qualify for some relevant voluntary standards. As shown in the table above, the aniline issue has been already observed in 13 structures (out of the general groups of around 50 AAA- and PMP-derived dyes). Additional findings may be reported as soon as more dyes are submitted for specific voluntary certifications.

All these products are of commercial importance both in the EU (many are registered in REACH in the 10-100 t/y volume band) and globally.

6 ETAD's recommendation

The collected data clearly show that the high aniline values detected in the analysed dyes are due to an issue with the applied method, while **dyed final articles are fully compliant with required limits and completely safe for the customer**.

To avoid that AAA- and PMP-derived dyes are rejected by customers for lack of specific certifications, **it is necessary that colorant manufacturers provide sufficient information on the aniline presence in these products, clarifying the occurrence of false positives and the safety of the products when used according to the appropriate application conditions.**

Considering the variability in the results reported by ETAD members, the information must be product-specific and backed up by corresponding data on performed analytical work.

All actors in the supply chain are invited to contact ETAD in case they have further questions about the information presented in this notice.