


# DIN EN 71-3:2021-06 (E)

## Safety of toys - Part 3: Migration of certain elements (includes Amendment A1:2021)

| <b>Contents</b>   | <b>Page</b> |
|---|-------------|
| European foreword.....  | 5           |
| Introduction .....  | 7           |
| 1 Scope.....  | 8           |
| 2 Normative references.....   | 8           |
| 3 Terms and definitions .....   | 8           |
| 4 Requirements.....   | 9           |
| 4.1 Toy material categories (see H.4) .....   | 9           |
| 4.2 Specific requirements.....  | 10          |
| 5 Principle .....   | 11          |
| 6 Reagents and apparatus .....  | 12          |
| 6.1 Reagents .....  | 12          |
| 6.2 Apparatus.....  | 12          |
| 7 Sampling and sample preparation.....  | 12          |
| 7.1 Selection of test portions.....   | 12          |
| 7.2 Sample preparation.....   | 13          |
| 7.2.1 General.....  | 13          |
| 7.2.2 Sampling.....   | 13          |
| 7.2.3 Dewaxing (see H.11) .....   | 15          |
| 8 Migration methodology .....   | 16          |
| 8.1 Preparation of test portions before migration testing.....  | 16          |
| 8.1.1 General.....  | 16          |
| 8.1.2 Category I: Dry, brittle, powder like or pliable materials and Category II: Liquid or sticky materials..... | 16          |
| 8.1.3 Category III: Scraped-off materials.....  | 16          |
| 8.2 pH adjustment (see H.10).....   | 17          |
| 8.2.1 General.....  | 17          |
| 8.2.2 pH adjustment - no buffering effect by toy material.....  | 17          |
| 8.2.3 pH adjustment - buffering effect by toy material.....   | 17          |
| 8.3 Migration procedure.....  | 18          |
| 8.3.1 Migration.....  | 18          |
| 8.3.2 Filtration (see H.8).....   | 19          |
| 9 Stabilization and analysis of migration solutions .....   | 19          |
| 9.1 General.....  | 19          |
| 9.2 General elements .....  | 19          |
| 9.3 Chromium (VI) .....   | 19          |
| 9.4 Organic tin .....   | 20          |
| 10 Calculation of results .....   | 20          |
| 10.1 Calculation of migration .....   | 20          |
| 10.1.1 General.....   | 20          |
| 10.1.2 Calculation of Chromium (III).....   | 20          |
| 10.2 Interpretation of results.....   | 21          |
| 11 Method performance .....   | 21          |

|         |  |    |
|---------|--|----|
| 11.1    | Repeatability and reproducibility .....  | 21 |
| 11.2    | Estimation of bias .....   | 23 |
| 11.3    | Limit of detection (LOD) and limit of quantification (LOQ) .....                                 | 23 |
| 12      | Test report .....  | 24 |
| Annex A | (informative) Significant technical changes between this document and the previous version ..... | 25 |
| Annex B | (informative) Information on method validation.....  | 27 |
| B.1     | General .....  | 27 |
| B.2     | Samples of interlaboratory comparison .....  | 27 |
| B.3     | Selection of material category/element combinations .....  | 28 |
| Annex C | (informative) Estimation of reproducibility.....   | 29 |
| Annex D | (informative) Toy material visual particle size comparison materials.....                        | 31 |
| Annex E | (normative) Method of analysis for general elements.....   | 33 |
| E.1     | Principle.....   | 33 |
| E.2     | Working solutions.....   | 33 |
| E.2.1   | Stock solution ( $M_1$ ).....  | 33 |
| E.2.2   | Diluted stock solution ( $M_2$ ) .....   | 34 |
| E.2.3   | Working solutions.....   | 34 |
| E.2.4   | Internal standard stock solution .....   | 34 |
| E.3     | Procedure .....  | 34 |
| E.4     | Analysis .....   | 34 |
| E.5     | Calculation.....   | 35 |
| E.5.1   | Calibration curve .....  | 35 |
| E.5.2   | Calculation of migration.....  | 35 |
| Annex F | (normative) Method of analysis for Chromium (VI) .....   | 36 |
| F.1     | Principle.....   | 36 |
| F.2     | Reagents.....  | 36 |
| F.3     | Apparatus .....  | 37 |
| F.4     | Procedure .....  | 38 |
| F.5     | Analysis .....   | 38 |
| F.5.1   | General .....  | 38 |
| F.5.2   | Chromatographic conditions.....  | 38 |
| F.5.3   | Limit of detection and quantification.....   | 39 |
| F.6     | Calculation.....   | 39 |
| F.6.1   | Calibration curve .....  | 39 |
| F.6.2   | Calculation of migration.....  | 40 |
| Annex G | (normative) Method of analysis for organic tin (see H.9) .....                                   | 41 |

|                     |  |           |
|---------------------|--|-----------|
| <b>G.1</b>          | <b>Principle</b> .....   | <b>41</b> |
| <b>G.2</b>          | <b>Reagents</b> .....  | <b>42</b> |
| <b>G.3</b>          | <b>Apparatus</b> .....   | <b>45</b> |
| <b>G.4</b>          | <b>Procedure</b> .....   | <b>45</b> |
| <b>G.4.1</b>        | <b>Sample derivatisation</b> .....   | <b>45</b> |
| <b>G.4.2</b>        | <b>Calibration standards</b> .....   | <b>47</b> |
| <b>G.5</b>          | <b>Analysis</b> .....  | <b>47</b> |
| <b>G.5.1</b>        | <b>General</b> .....   | <b>47</b> |
| <b>G.5.2</b>        | <b>Example of GC conditions</b> .....  | <b>49</b> |
| <b>G.5.3</b>        | <b>Example of MS conditions</b> .....  | <b>49</b> |
| <b>G.5.4</b>        | <b>Limit of detection and quantification</b> .....   | <b>49</b> |
| <b>G.5.5</b>        | <b>Example of a GC-MS chromatogram</b> .....   | <b>50</b> |
| <b>G.6</b>          | <b>Calculation</b> .....   | <b>51</b> |
| <b>G.6.1</b>        | <b>Calibration curve</b> .....   | <b>51</b> |
| <b>G.6.2</b>        | <b>Standard addition</b> .....   | <b>51</b> |
| <b>G.6.3</b>        | <b>Calculation of migration of organic tin</b> .....   | <b>51</b> |
| <b>Annex H</b>      | <b>(informative) Rationale</b> .....   | <b>53</b> |
| <b>H.1</b>          | <b>General</b> .....   | <b>53</b> |
| <b>H.2</b>          | <b>Mouthing behaviour of children (see Clause 1)</b> .....   | <b>53</b> |
| <b>H.3</b>          | <b>Skin contact (see Clause 1)</b> .....   | <b>54</b> |
| <b>H.4</b>          | <b>Toy categories (see 4.1)</b> .....  | <b>54</b> |
| <b>H.5</b>          | <b>Test portions (see Clause 7)</b> .....  | <b>54</b> |
| <b>H.6</b>          | <b>Size of test pieces (see 7.2)</b> .....   | <b>54</b> |
| <b>H.7</b>          | <b>Stability of Chromium (VI) in the migration solution (see 9.3)</b> .....  | <b>55</b> |
| <b>H.8</b>          | <b>Filtration of migration solutions (see 8.3.2)</b> .....   | <b>55</b> |
| <b>H.9</b>          | <b>Organic tin (see Annex G)</b> .....   | <b>55</b> |
| <b>H.10</b>         | <b>pH value (see 8.2 and 8.3.1.2)</b> .....  | <b>57</b> |
| <b>H.11</b>         | <b>De-waxing (see 7.2.3)</b> .....   | <b>57</b> |
| <b>Annex ZA</b>     | <b>(informative)  Relationship between this European Standard and the essential requirements of EU Directive 2009/48/EC aimed to be covered</b> ..... | <b>58</b> |
| <b>Bibliography</b> | .....  | <b>59</b> |