

# TOC determination in solids

In the field of waste recycling and landfills the current law on waste requires the detection of the total organic carbon content (TOC) in the original sample. With the progress of the implementation of the EU Directive on the simplification of landfill legislation the detection of the elemental carbon (EC) in waste also plays an increasing role. An important position is given to the TOC parameter also in the field of materials testing for raw materials and finished product control (e.g. lime stone, plaster, cement) and in environmental monitoring and agriculture from the matrices soil, fertilizer and sediments.

The determination of the parameter TOC in waste, sediments and sludges is regulated in DIN EN 13137 (in Europe) which is intended to be replaced by DIN EN 15936. This permits two different methods: TOC detection using the so-called direct method and the differential method. Another option for the detection of the TOC in specific matrices (e.g. sediments, soil, lime stone) is the so-called suspension method. Different devices and technologies can be used to detect the parameter TOC in solid samples.



## multi EA® 4000 C

- Carbon analyzer predestined for the TOC and TC detection in solid and paste-like samples
- Real macro elemental analyzer: permits weighted samples of up to 3 g in ceramic boats – therefore also reliable analysis of less homogeneous samples
- Catalyst-free high temperature digestion in the oxygen flow at up to 1,500 °C in almost wear-free ceramic combustion tubes
- Broad range NDIR detector for CO<sub>2</sub> detection for large measuring range dynamics; both small contents (from 10 µg C absolute) and large contents (up to 500 mg C absolute) are detected safely
- Effective cleaning of the sample gas and special optical arrangement of the NDIR detection system make the device extremely robust for the analysis of corrosive materials or direct TOC detection (with acidified solid samples)
- Unique: automatic TIC determination – can be combined with subsequent direct detection of TOC using the autosampler and the TIC automatic module
- Optional pyrolysis function allows the detection of elemental carbon (EC) and the bio-degradable organic carbon (BOC) or active carbon.
- Integration of an analytical balance for the automatic transfer of sample weights



## multi N/C® with solids modules

- Devices of the multi N/C® series are TOC instruments suitable for the analysis of aqueous samples
- The „liquid TOC devices“ can, in combination with add-on modules, also be used excellently for the detection of TOC in solids
- For this purpose two solids options are available: the double furnace solids module and the high temperature combustion system HT 1300
- The Focus Radiation NDIR detector integrated into the multi N/C® is, due to its large dynamic measuring range, particularly suited for the detection of high TOC content (up to 500 mg C absolute) in solids
- The device combinations multi N/C® + solids module are recommended for laboratories detecting mainly TOC in aqueous samples and with low numbers of TOC solid samples
- Automation for the solids mode is not available
- Devices of the multi N/C® series are also suited for the TOC detection in solids based on the suspension method – this requires no special accessories

# TOC determination in solids

- Automation possible for up to 48 sample boats
- Device is recommended for laboratories with a high sample throughput in TOC solid samples
- The device can be upgraded for the detection of other elements (sulfur, chlorine) at any time

## TIC determination

For the direct detection of TIC in solids two modules are available:

### The TIC solids module

- The sample is weighed in an Erlenmeyer flask, the sample volume can be varied in the gram range
- The sample is manually acidified using a dispenser
- Integrated stirring and heating support the complete purging of carbon dioxide
- Generated carbon dioxide is transferred to the NDIR detector of the basic device multi EA® 4000 C
- The module is suitable for manual operation; automation with auto sampler is not possible

### The „automatic“ TIC solids module

- Complements the multi EA® 4000 C for the automatic detection of TIC (TC, TOC) in solids
- Acidification takes place automatically in the sample boat
- Generated carbon dioxide is transferred to the NDIR detector of the multi EA® 4000 C
- Various analysis modes are possible: TIC detection, TOC detection based on the differential method or the direct method
- Suitable only for automatic operation; only works in combination with the automatic sampler FPG 48

### Automation capability

- Solids sampler FPG 48 for the automatic supply of up to 48 solid or paste-like samples to the combustion system of the multi EA® 4000
- Sample supply via ceramic boat
- Stopping point and feeding speed can be programmed
- Robust and space-saving design

## Double Furnace solids add-on

- Catalyst-supported high temperature combustion in the quartz combustion tube, no additional furnace required
- A compact, space-saving alternative for analyzing solids
- Conversion between solids and liquid mode required: change of combustion tube
- Furnace temperature up to 950 °C
- Sample mass up to 0.5 g, manual sample feed in quartz boats
- Suitable for connection to multi N/C® 2100, 2100 S

## HT 1300 solids add-on

- Catalyst-free high temperature combustion in a robust ceramic combustion tube using an additional furnace
- Maximum furnace temperature: 1300 °C, when using additives of up to 1800 °C
- Change between liquid and solids mode possible by the click of the mouse, no change of combustion tube necessary
- Weighted samples of up to 3 g – large sample amount advantageous for sample material with low homogeneity
- Manual sample supply in ceramic boats
- Suitable for connection to multi N/C® 2100, 2100 S, 3100 and multi N/C® UV HS



## Recommendations

Device models for pure solids operation:	multi EA® 4000 C
Device models and combinations for liquid and solids operation:	multi N/C® 2100/S + double furnace solids module or HT 1300
	multi N/C® 3100 + HT 1300
	multi N/C® UV HS + HT 1300
Accessories/options:	TIC solids module for multi EA® 4000 C or multi N/C® 2100/S, 3100, UV HS
	„Automatic“ TIC solids module for multi EA® 4000 C
	FPG 48 for multi EA® 4000 C
	Pyrolysis option for multi EA® 4000 C

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Subject to changes in design and scope of delivery as well as further technical development!