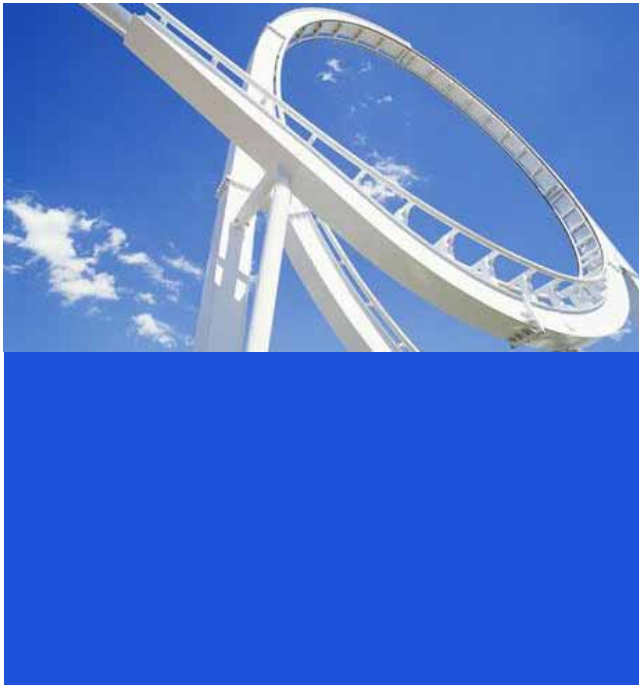


SASOL
reaching new frontiers



Aktivitäten der Kerzenindustrie

Würzburg, 25. April 2008

von Dr. Michael Matthäi, Helmut Gutberlet

Sasol Wax
Wax is all we do. So we do it best.



Vorträge seit 2001

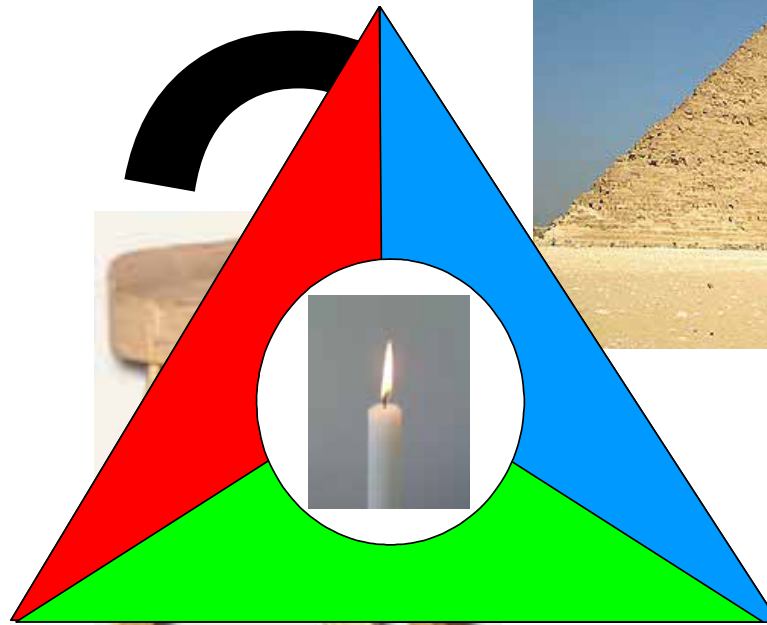
- Würzburg 2001: Kerze und Ruß
- Würzburg 2002: Die ideal brennende Kerze
- Würzburg 2003: Methode zur Rußmessung
- Würzburg 2004: Qualitätsnormen Kerzen
- Würzburg 2005: Sicherheit von Kerzen, Statusbericht
- Würzburg 2006: Sicherheit von Kerzen
- Europäisches Kerzenmeeting 2007: Candle Emissions



Einleitung



Gütezeichen

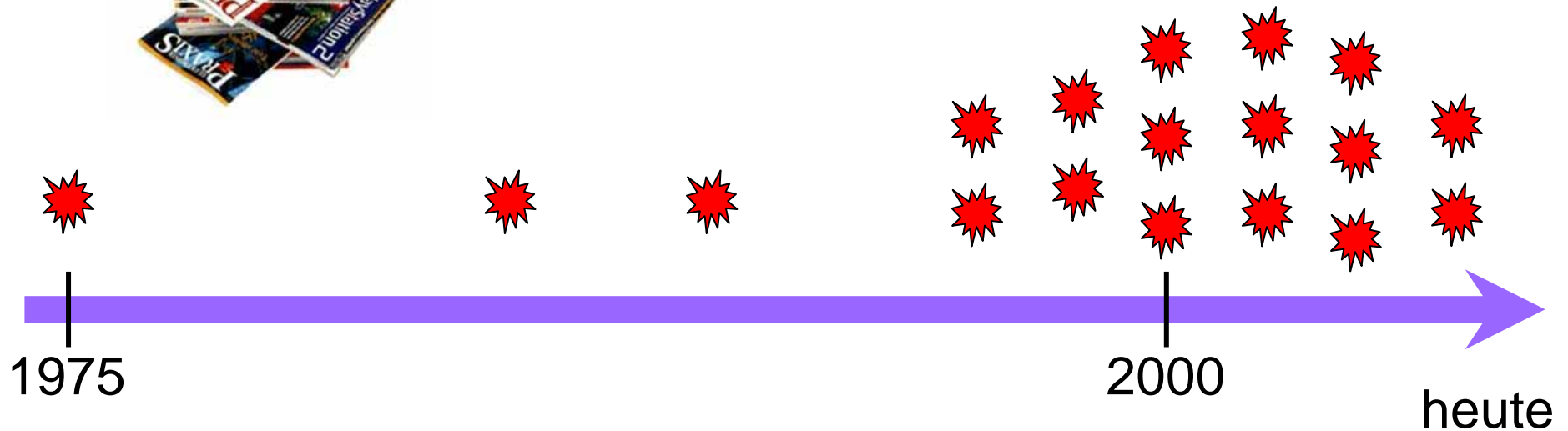


Norm

Ökometric






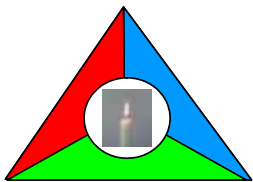
Negative Berichte über die Kerze





Drei Hauptkriterien

- **Eingesetzte Rohstoffe** – was ist in unseren Kerzen? 
- **Die Abbrandprodukte** – wie gut brennen unsere Kerzen? 
- **Feuersicherheit** – wie sicher sind unsere Kerzen? 





Wie gut brennen unsere Kerzen?





Was ist in unseren Kerzen?



Rohstoffe

- Paraffin
- Mikrowachs
- Bienenwachs
- Stearin
- Fett

Additive

- Polymere
- Antioxidantien
- UV Absorber
- Klebstoff

Effektmaterialien

- Lack
- Farbe
- Dekorelemente
- Duft

Docht



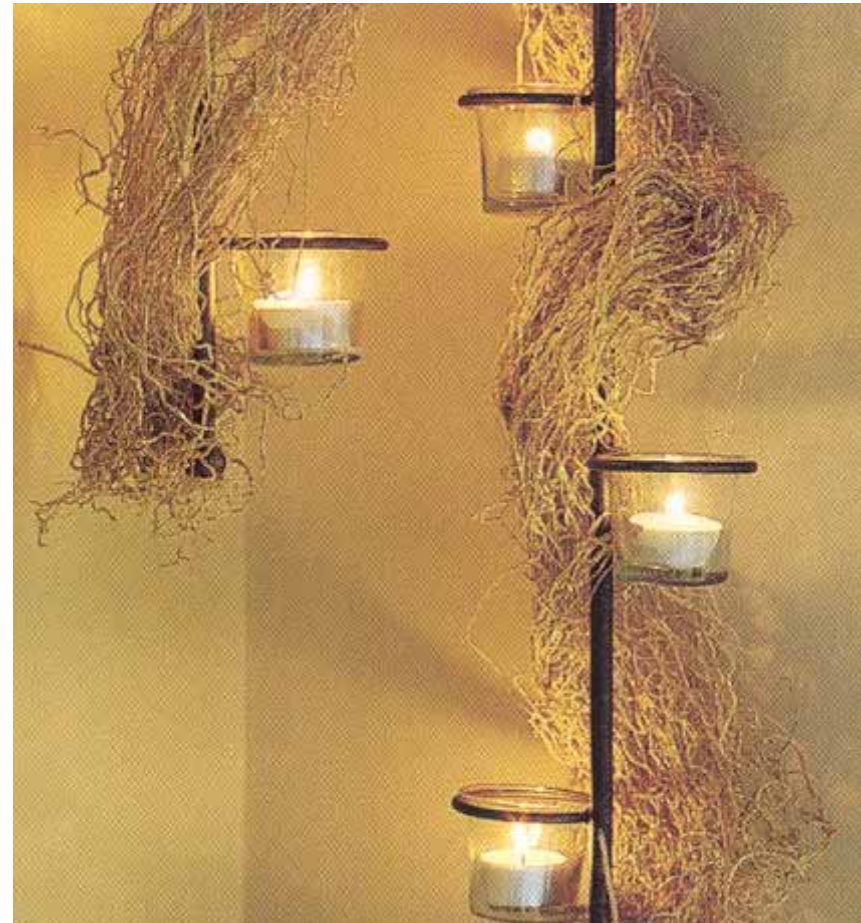


Wie sicher sind unsere Kerzen?





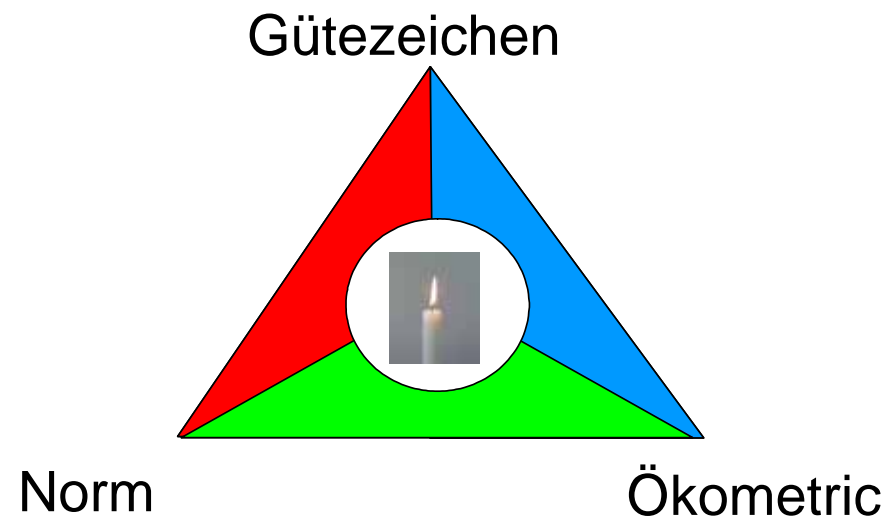
Wie sicher sind unsere Kerzen?





Drei Hauptaktivitäten

1. Qualität – Gütegemeinschaft
2. Sicherheit – CEN
3. Abbrandprodukte – CEN (Norm), Ökometric (Daten)



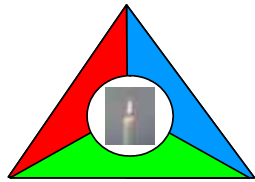


CEN – Europäische Sicherheitsnormen



European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

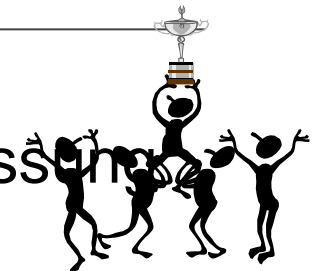
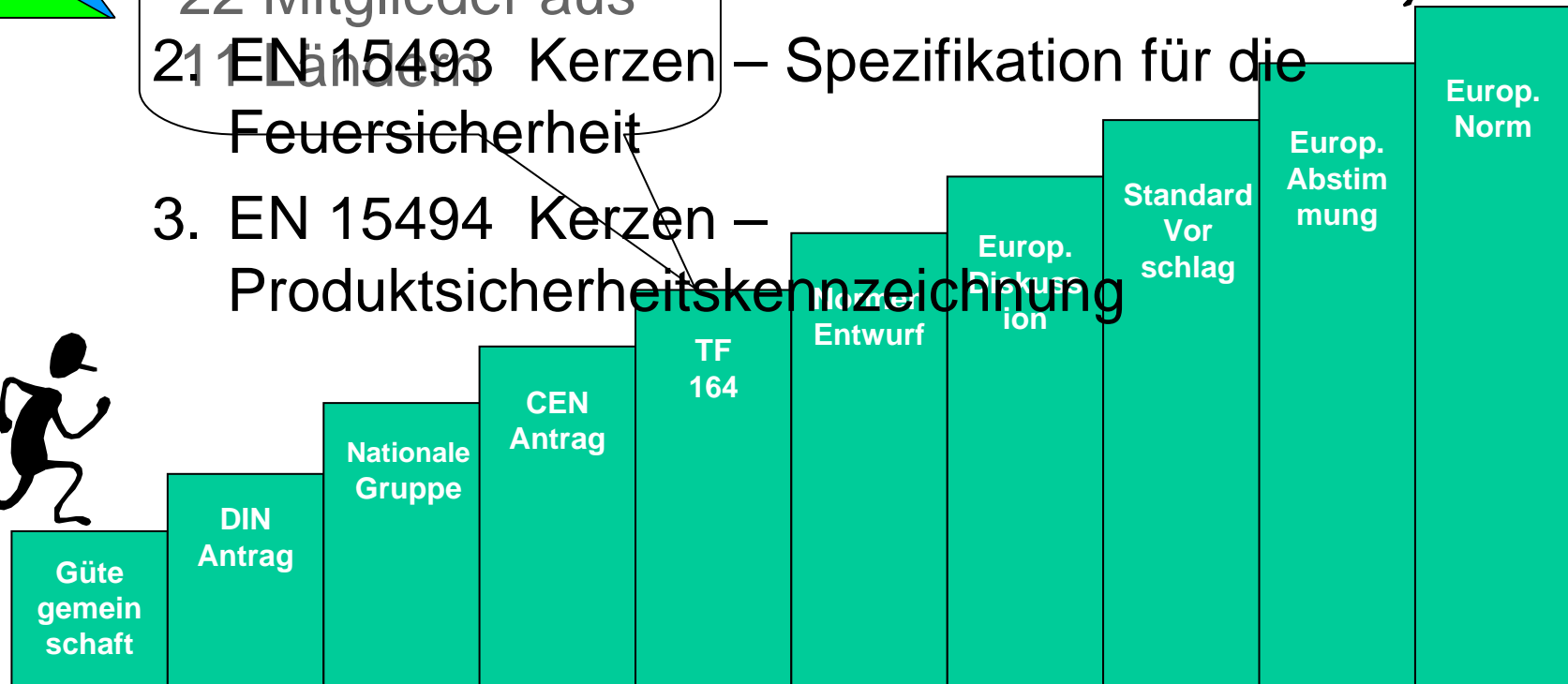
Europäische Kerzennormen



1. EN 15426 Kerzen – Spezifikation zur Messung des Rußverhaltens

2. EN 15493 Kerzen – Spezifikation für die Feuersicherheit

3. EN 15494 Kerzen – Produktsicherheitskennzeichnung



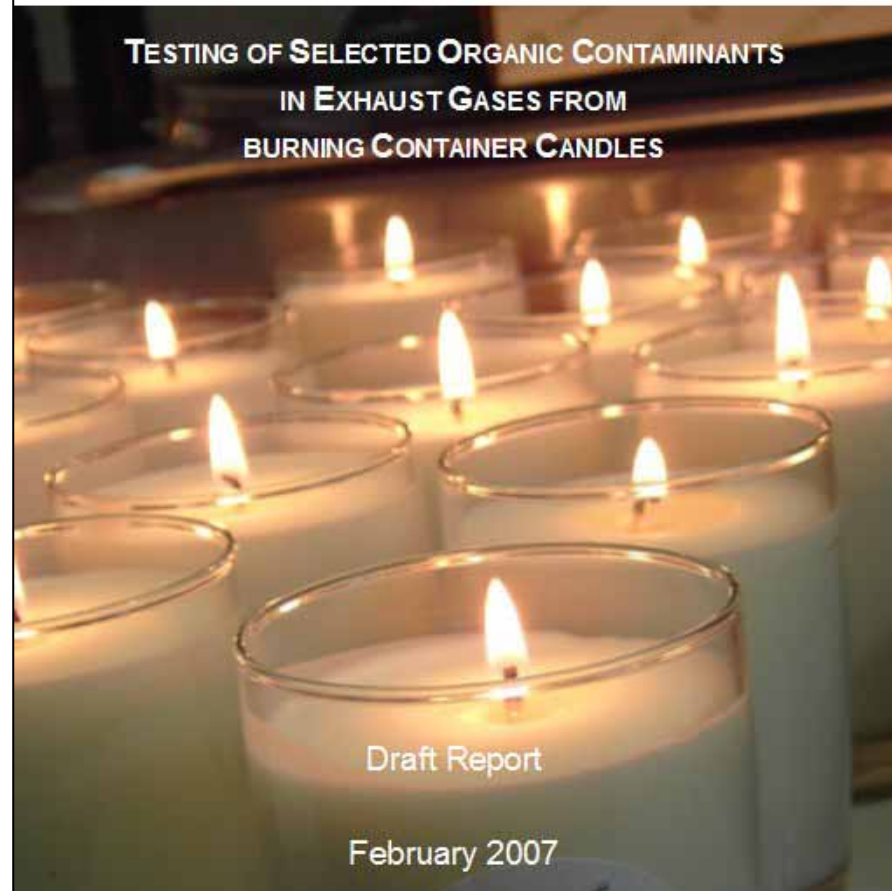


Die Ökometric Studie

eurofins

Ökometric

TESTING OF SELECTED ORGANIC CONTAMINANTS
IN EXHAUST GASES FROM
BURNING CONTAINER CANDLES



Draft Report

February 2007

- IGI
- Sasol Wax



Gemeinschaftsstudie – die Beteiligten



NCA

*Dedicated to the Enjoyment,
Quality, Safety, and Science of Candles*



alafave

Asociación Latino Americana De Fabricantes De Velas



AECM



NPRA

CargillTM

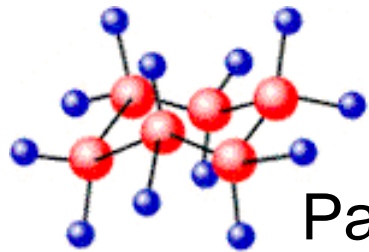


European Wax Federation

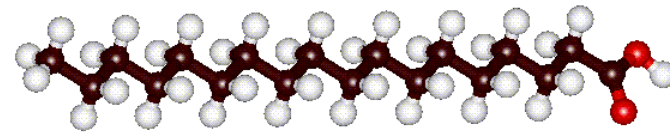
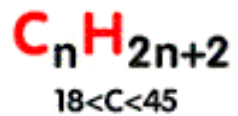
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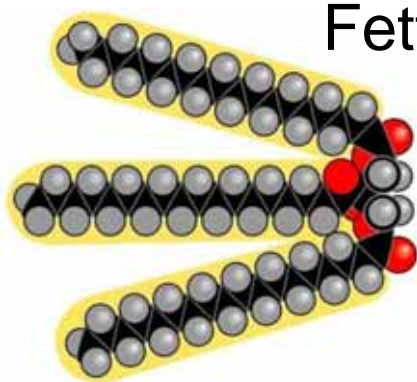
Untersuchte Kerzenrohstoffe



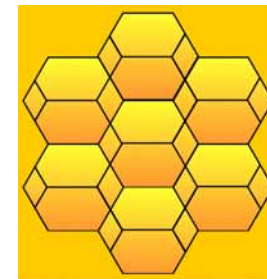
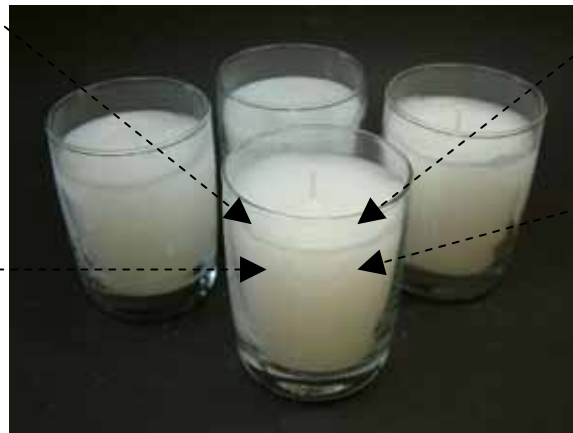
Paraffin



Stearin



Fette

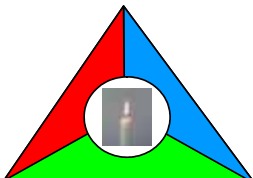


Bienenwachs



Zweck der Studie

- Die Charakterisierung der Emissionen unterschiedlicher Kerzenrohstoffe
- Vergleich der Resultate mit Grenzwerten der untersuchten Substanzen
- Untersuchung der Korrelation von sichtbaren und unsichtbaren Emissionen bei verschiedenen Kerzenrohstoffen



Ergebnisse der Emissionsmessung

Ökometric - Candle Emissions, Results, 2007

LAB - ID		860/06-2	860/06-3	860/06-6	860/06-7	860/06-8	860/06-4	860/06-5
Material	Unit	Paraffin	Soy	Palm	Stearin	Beeswax	Paraffin (high sooting)	Soy (high sooting)
Formaldehyde	µg/g wax	0,657	1,170	1,77	0,859	0,981	3,11	2,23
Acetaldehyde	µg/g wax	< 0,100	0,697	0,532	0,243	0,317	2,073	2,73
Propionaldehyde	µg/g wax	< 0,100	0,265	0,526	0,36	0,43	0,735	0,543
Acroleine	µg/g wax	< 0,100	< 0,100	< 0,100	< 0,100	< 0,100	< 0,100	< 0,100
Dioxin								
PCDD/F	l-TE pg/g wax	0,008	0,009	0,011	0,008	0,029	0,057	0,034
PAH (excl. Naphthalene, Acenaphthylene)								
PAH	ng/g wax	3,71	3,36	3,46	2,74	3,97	15,59	13,87
Benzo-a-pyrene								
Benzo-a-pyrene	ng/g wax	0,017	0,011	0,014	0,004	0,006	0,021	0,027
Naphthalene								
Naphthalene	ng/g wax	18,8	26,2	17,8	8,4	26,2	21	19,3
Total VOC								
Total VOC	µg/g wax	4,08	3,07	10,7	5,09	3,87	2,84	1,79
Benzene								
Benzene	µg/g wax	< 0,09	< 0,07	< 0,08	< 0,07	< 0,07	0,06	0,12
1-Methoxy-2-propanol								
1-Methoxy-2-propanol	µg/g wax	< 0,09	< 0,07	< 0,08	1,11	0,51	0,32	< 0,06
Benzaldehyd								
Benzaldehyd	µg/g wax	2,18	1,17	1,96	1,25	1,23	1,03	0,87
Condensate								
Condensate	µg/g wax	6	9	10	6	33	273	146
Wax Consumption								
Wax Consumption	g/h/candle	4,2	4,2	4,7	4,8	4,8	6,5	7,6



Emissionsniveau

Wie groß ist 1 ng?

1 ng = 0,000000001 g

oder

1 ng steht im gleichen Verhältnis
zu 1 g wie zwei 10-Cent-Stücke
zum Gewicht des Eiffelturms.

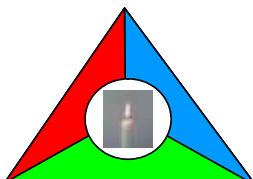




Vergleich der Rohstoffe

Alle untersuchten Rohstoffe:

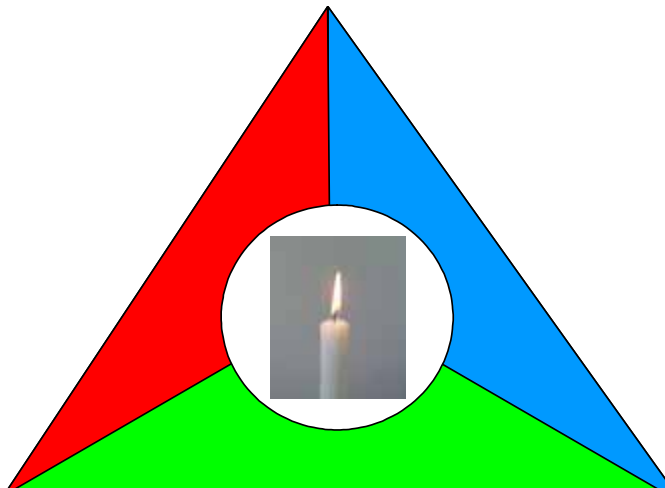
- emittieren die selben chemischen Substanzgruppen
- emittieren Mengen in der gleichen Größenordnung
- die Gesamtemission ist sehr gering und liegt weit unterhalb eines möglichen Gefährdungspotentials



Weiteres Vorgehen

Die nächsten Schritte

- Pressemitteilung
- Allgemeinverständliche Kurzform
- Wissenschaftlicher Artikel



Candle Science & Testing

Report on the Ökometric Wax and Emissions Study

A new, internationally funded study on candle emissions has confirmed that well-made candles of all major wax types exhibit the same clean burning behavior and pose no discernible risks to human health or indoor air quality.

The independent laboratory testing, conducted in late 2007 at Germany's Beylwoth Institute of Environmental Research in Germany (Ökometric GmbH), constitutes the most extensive and rigorous scientific investigation of candle emissions to date.

In carrying out the tests, reference candles made from paraffin, soy wax, searfin, palm wax and beeswax were burned in a specialized testing chamber.

Emission gases were analyzed for more than 300 chemicals known or suspected of toxicity, health risks or respiratory irritation at elevated concentrations.

Targeted chemical groups included dioxins and furans, polycyclic aromatic hydrocarbons, short-chain aldehydes and volatile organic compounds. Recorded emission levels were then compared to any known applicable indoor-air standards.

The study found all of the waxes burned cleanly and safely, with no appreciable differences in burning behavior. Their combustion byproducts were virtually identical in composition and quantity with all emissions levels registering far below the most restrictive of any applicable indoor-air standards. (See Table 1 on right.)

A similar but less extensive study of paraffin, searfin and beeswax candles was conducted by the Beylwoth Institute in 1994.

By comparison, the 2007 study added soy and palm to the candle waxes tested, and expanded the list of target analytes to include an extensive number of volatile organic compounds as well as the polycyclic aromatic hydrocarbons, dioxins and aldehydes investigated in 1994. No significant differences could be detected between the 1994 and 2007 investigations.

A global consortium of industry groups and companies sponsored the Ökometric study. Funding was provided by the Association of European Candle Manufacturers (AECM); the Associação Latino Americana De Fabricantes De Velas (ALAEAVE); Cargill, Incorporated; the European Wax Federation (EWF); the National Candle Association (NCA), and the National Petrochemical & Refiners Association (NPRA).

Sasol Wax GmbH and The International Group, Inc. contributed through the preparation and certification of the testing samples and provision of project management personnel.

For the 2007 study, the Ökometric investigators were also asked to undertake a preliminary look at the behavior of sooting candles and the formation of particulates matter. The results of these related investigations are discussed later in this report.

Study Methodology
All laboratory testing was conducted at the Ökometric facility in Hamburg, Germany using a burn chamber specifically developed for candle testing and producing uni-

form burning conditions comparable to real-room situations.

Container candles consisting solely of a base wax material and wick (no fragrance or colorants) were made for each of the five waxes to be tested. The containers were 6.5 cm wide by 7.6 cm high (2.56 x 3") and held approximately 250 grams (8.8 oz) of wax.

The five waxes were selected as representative of those most widely used in the global candle industry and the wicks were appropriate to the different waxes. Care was taken to ensure that the reference candle systems burned efficiently and as comparable wax consumption rates.

For each wax type, nine test candles were burned simultaneously in the test chamber to obtain enough emissions to be detected

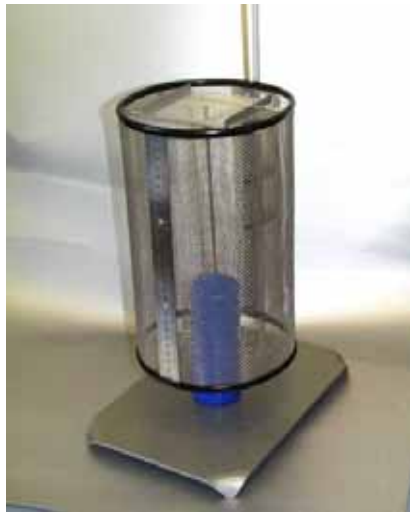
All of the waxes burned cleanly and safely with no appreciable differences in burning behavior. Their combustion byproducts were virtually identical in composition and quantity... far below the most restrictive of any applicable indoor-air standards.

TARGET COMPOUND	EMISSION RATES* (all waxes)	AVERAGE EMISSION RATE	AVERAGE AIR LEVEL**	STRICTEST INDOOR AIR STANDARD	% of STD
Dioxins/Furans	0.006 - 0.009 µg I-TEQ/g	0.013 µg I-TEQ/g	0.006 µg I-TEQ/m ³	0.8 µg I-TEQ/m ³ [D]	1%
Total PAHs	0.737 - 3.377 µg/g	n/a	n/a	n/a	
Benzo[a]pyrene	0.004 - 0.017 µg/g	0.010 µg/g	0.004 µg/m ³	1.0 µg/m ³ [D]	<1%
Total VOCs	3.07 - 10.7 µg/g	5.34 µg/g	1.574 µg/m ³	200.0 µg/m ³ [D]	1%
Benzene	not detected	n/a	n/a	5.0 µg/m ³ [D]	-
Aldehydes					
Formaldehyde	0.62 - 1.77 µg/g	1.066 µg/g	0.337 µg/m ³	60.0 µg/m ³ [D]	<1%
Acetaldehyde	<0.10 - 0.70 µg/g	0.376 µg/g	0.137 µg/m ³	3.0 µg/m ³ [D]	<6%
Acrolein	not detected	n/a	n/a	n/a	-
Propionaldehyde	<0.10 - 0.53 µg/g	0.336 µg/g	0.109 µg/m ³	10.0 µg/m ³ [D]	<2%

* Emission rates are per gram of wax. Based on an average of nine candles burned simultaneously for each wax type.
** Conversion of average emission rates to volume. Based on burning a candle for 4 hours in 60m³ room.
[D] WHO/ECDC [D] EPA ambient [D] AQIC maximum [D] EPA RfC (see page 6 for descriptions)



Rußindex \Leftrightarrow Emissionen?



CEN Methode



Ökometric



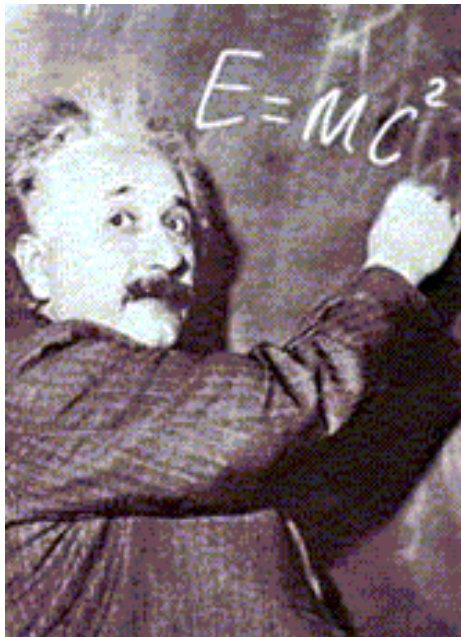


Rußindex – Emissionen





Die Erfolgsformel



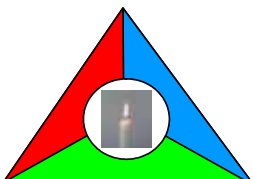
1. qualitativ hochwertige Rohstoffe
- +
2. Kerzen Know-how (z. B. Dochtwahl)
- +
3. ständige Qualitätskontrollen (z. B. Rußmessung)

=

Qualitätskerzen



ohne Gefahr für Mensch und Umwelt





Erfahrungen



„Wo viel Licht ist, ist auch viel Schatten.“

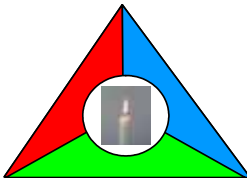
Götz von Berlichingen

„Es hört doch jeder nur, was er versteht.“

„Mit dem Wissen wächst der Zweifel.“

Faust, Teil 1

Johann Wolfgang von Goethe





Kerzen hatten, haben und werden auch weiterhin ein sehr positives Image besitzen. Erfreuen wir uns an ihnen!



SASOL
reaching new frontiers



Vielen Dank für Ihre Aufmerksamkeit.

Sasol Wax
Wax is all we do. So we do it best.