

# **Comparison of in vitro smoke toxicity of novel charcoal filter cigarettes and benchmark cigarettes from the UK market**

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# Objective and experimental approach

- To assess differences of smoke toxicity of test cigarettes with highly effective charcoal filters vs marketed cigarettes of similar ISO tar yields.
- For this purpose, test cigarettes with ISO tar yields of 10, 6 and 3 mg were manufactured and compared with two leading UK brands of similar tar yields (CA filter).
- Smoke was generated according to the ISO Standard (35 mL/60 sec/2 sec, no vent blocking) and the Canadian Intense regime (CINT, 55/30/2, 100% vent blocking), respectively.

# Experimental cigarettes & details

Code	ISO			CINT		
	puffs	total Part. Matter TPM [mg/cig]	water free Part. Matter DPM [mg/cig]	puffs	total Part. Matter TPM [mg/cig]	water free Part. Matter DPM [mg/cig]
<b>X CF</b>	7.3	<b>10.4</b>	9.6	10.8	<b>42.2</b>	27.8
X B1	6.8	<b>14.6</b>	12.3	8.9	<b>41.0</b>	23.3
X B2	7.4	<b>11.1</b>	10.0	9.8	<b>41.1</b>	23.8
<b>VI CF</b>	7.2	<b>6.3</b>	6.0	8.2	<b>36.9</b>	26.3
VI B1	7.4	<b>6.9</b>	6.4	8.5	<b>35.3</b>	22.9
VI B2	8.1	<b>6.4</b>	6.2	9.8	<b>38.0</b>	23.5
<b>III CF</b>	7.7	<b>3.6</b>	3.5	7.9	<b>39.7</b>	25.9
III B1	6.6	<b>3.7</b>	3.5	7.9	<b>29.3</b>	19.3
III B2	7.8	<b>3.1</b>	3.0	8.7	<b>32.5</b>	22.8

# Exposure Methods




## **Toxicity tests with Hep-G2** (ATTC HB-8065)

*human hepatoma cell line adapted to serum free medium.*

*Treatment in 96-mutiwell plates over 65 hours.*

- **Fresh Whole Smoke in direct contact with the cells** (NRU)  
(Bt020 aerosol system from Heinrich Burghart GmbH; Wedel, Germany)
- **Whole Smoke and Vapour Phase bubbled through an impinger containing serum free medium** (NRU and MTS)
- **Cigarette Smoke Condensate in DMSO** (NRU and MTS)

# Test materials

	carrier	time after 1 <sup>st</sup> puff to contact with cells	particulate phase fraction	vapour phase fraction	% influence VP on WS (CA filter – ISO)
 <p>fresh smoke</p>	aerosol in ambient air	4 sec.	native	native	NRU/MTS ~45%
 <p>smoked medium</p>	medium with 0.5% DMSO	30 min.	aqueous solution (partial)	aqueous solution (partial)	NRU ~50% MTS ~65%
 <p>CSC in DMSO</p>	DMSO	≥ 60 min.	99.9% captured	?	not appl.

# Contents

## ISO & CINT smoking regime

- **Condensate toxicity**
- **Whole Smoke toxicity
  - **fresh smoke**
  - **smoked medium** (bubbled)**
- **Toxicity of Vapour Phase bubbled medium**
- **Contribution of VP to WS toxicity**
- **Effect of Charcoal on Whole Smoke toxicity**

# Condensate toxicity - EC50

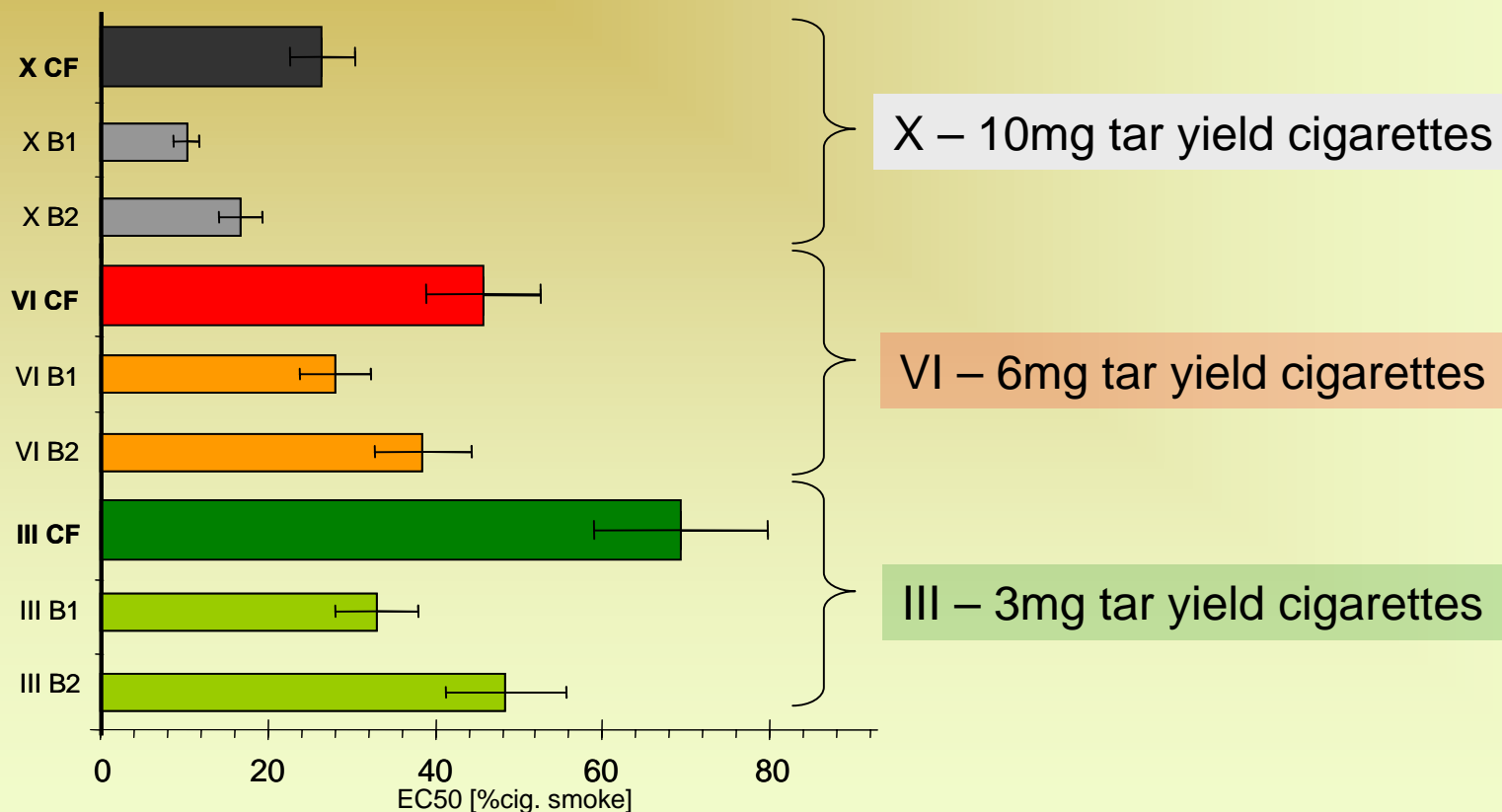
Code	ISO		CINT	
	NRU	MTS	NRU	MTS
<b>X CF</b>	17.4	21.4	17.6	23.2
<b>X B1</b>	22.4	20.9	20.2	22.3
<b>X B2</b>	19.9	20.7	16.6	21.4
<b>VI CF</b>	14.5	13.7	16.6	24.0
<b>VI B1</b>	15.2	22.8 *	17.1	28.7
<b>VI B2</b>	16.6	20.0 *	18.0	26.8
<b>III CF</b>	12.2	18.2	15.2	23.8
<b>III B1</b>	15.7	22.6	19.8	30.0
<b>III B2</b>	16.3	21.4	25.4 *	32.6 *

\* -significant difference to the corresponding test cigarette under consideration of condensate yield (+/- 15%)

# Fresh Smoke Toxicity (NRU) - ISO

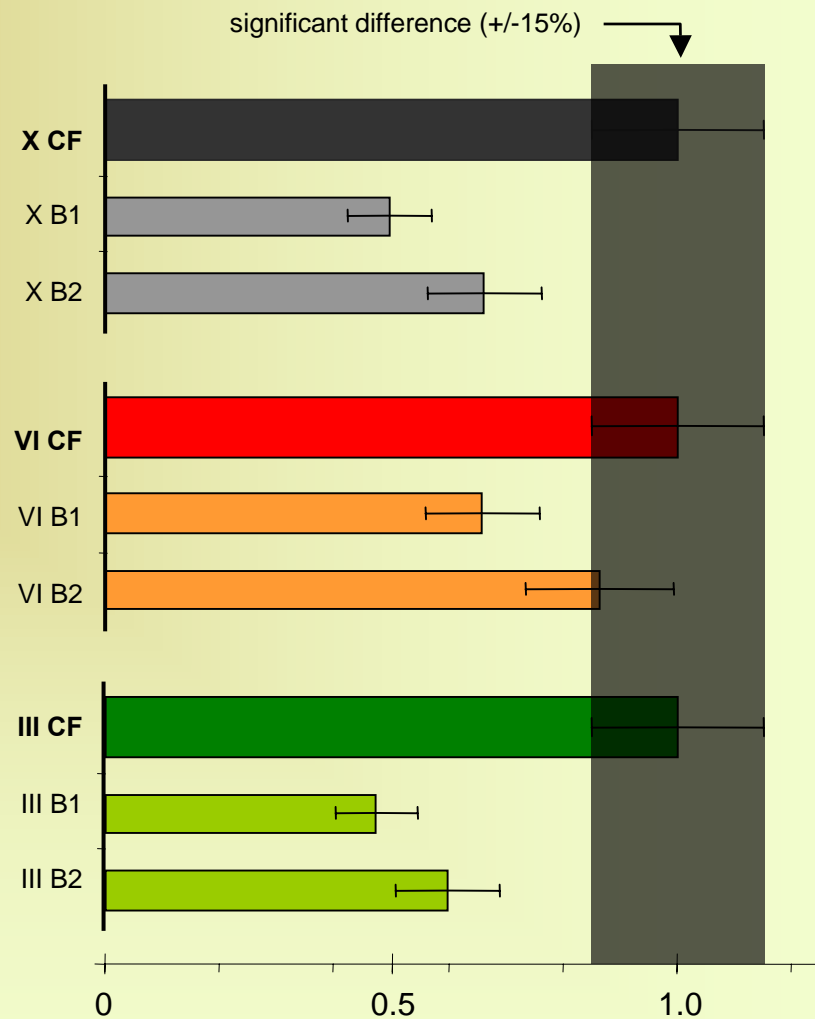
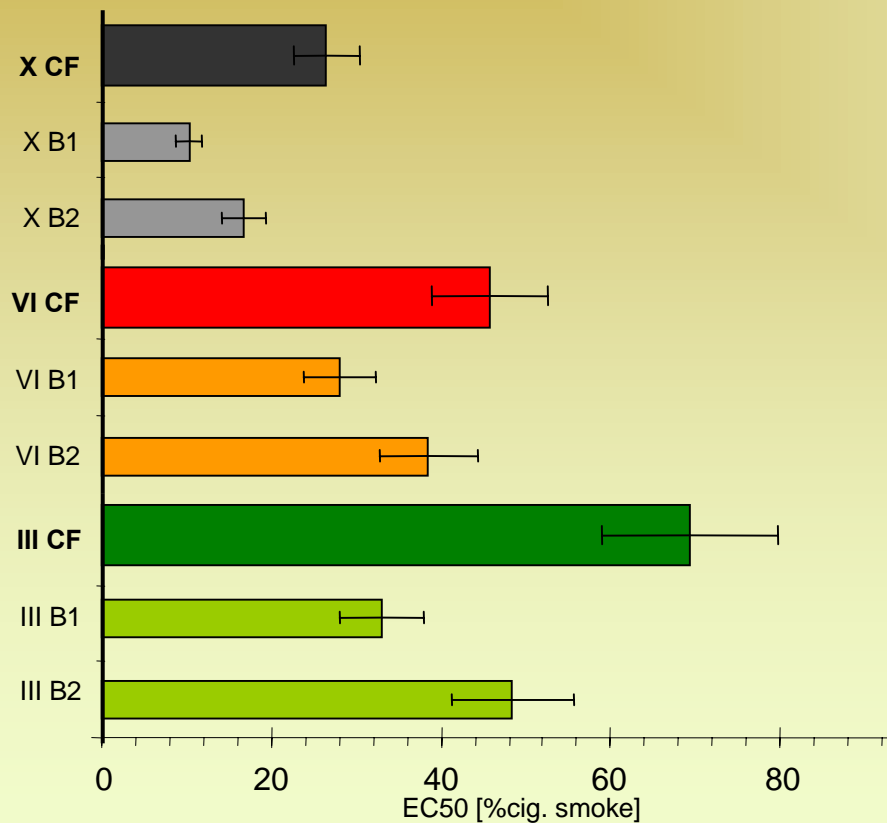
**CF** – charcoal filter cigarette

**B1 & B2** – bench mark cigarette

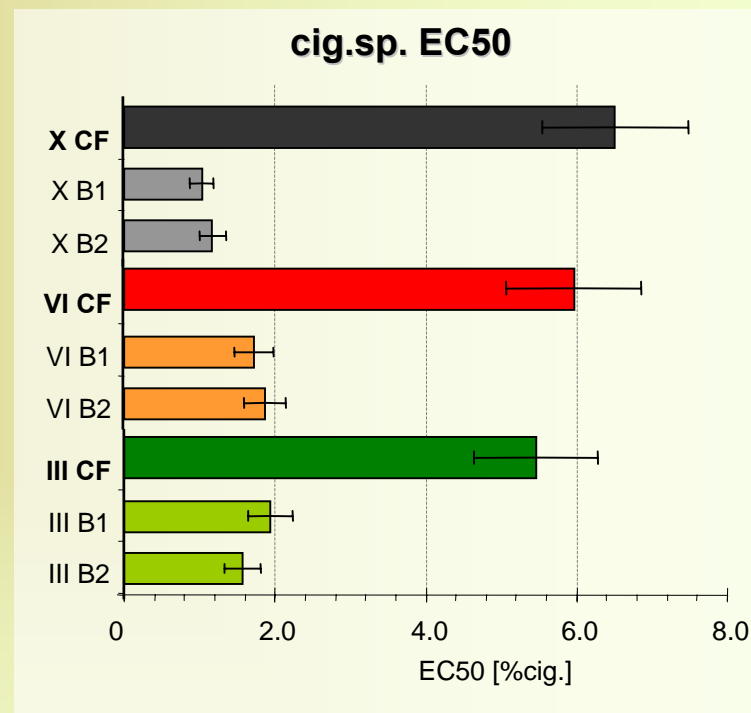
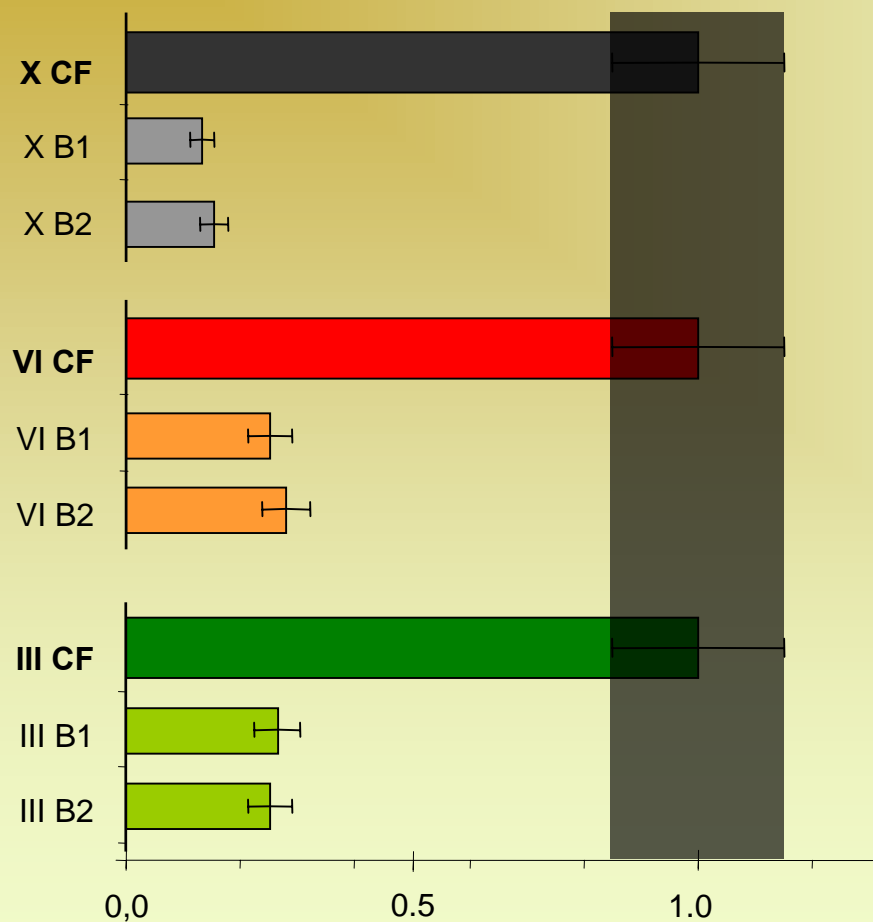




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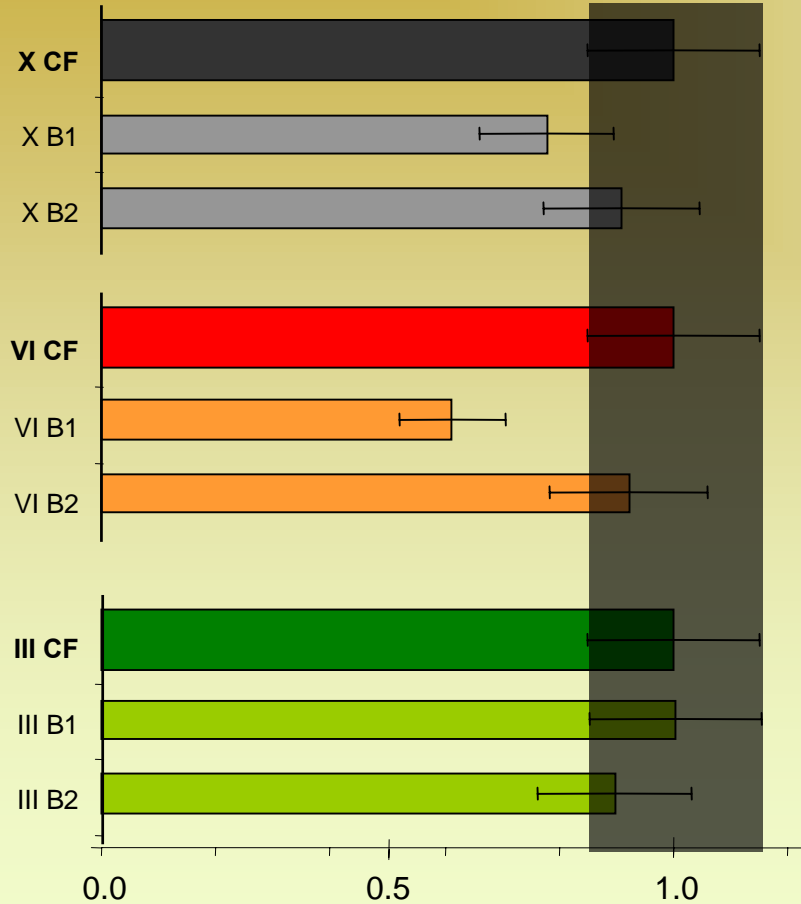


# Fresh Smoke Toxicity (NRU) - CINT

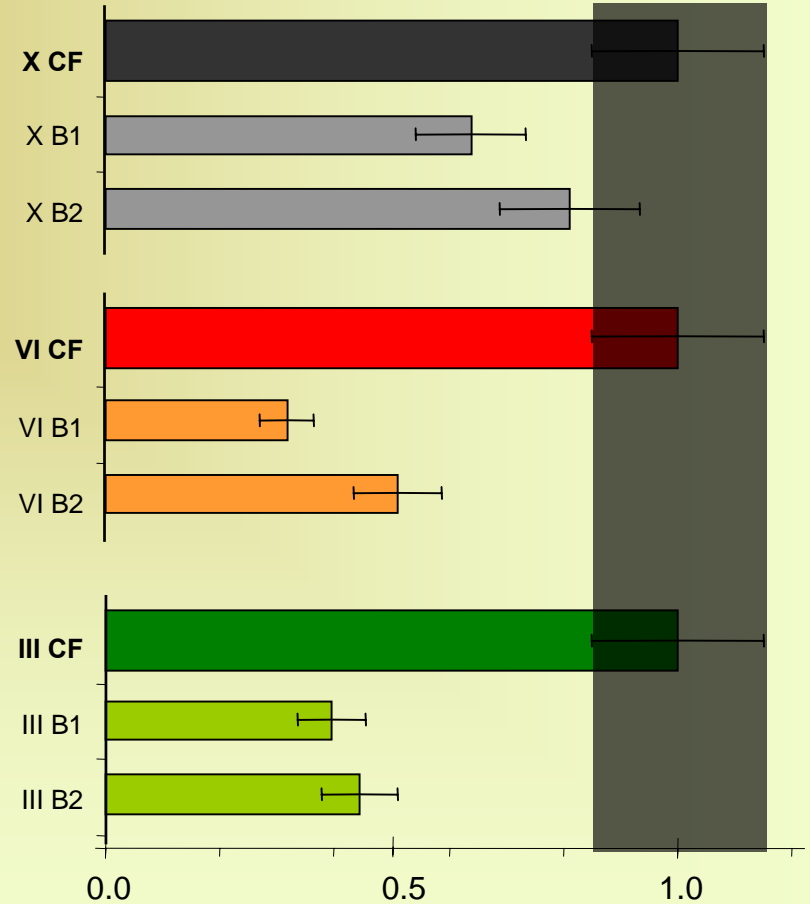


# Smoked Medium Toxicity - ISO

**NRU**



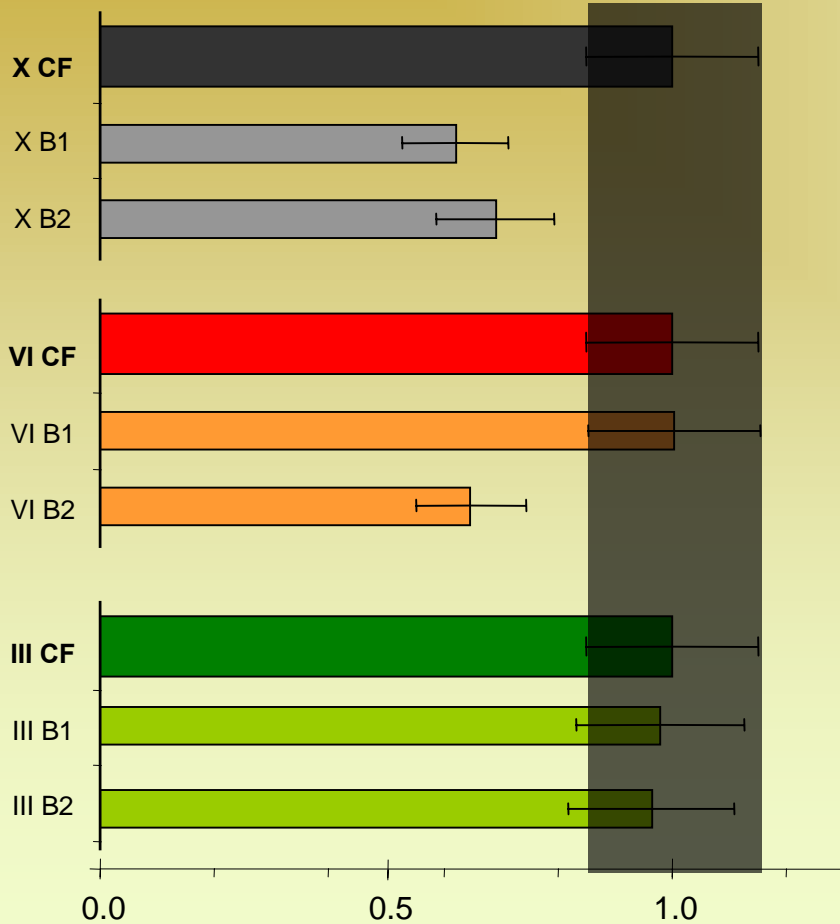
**MTS**



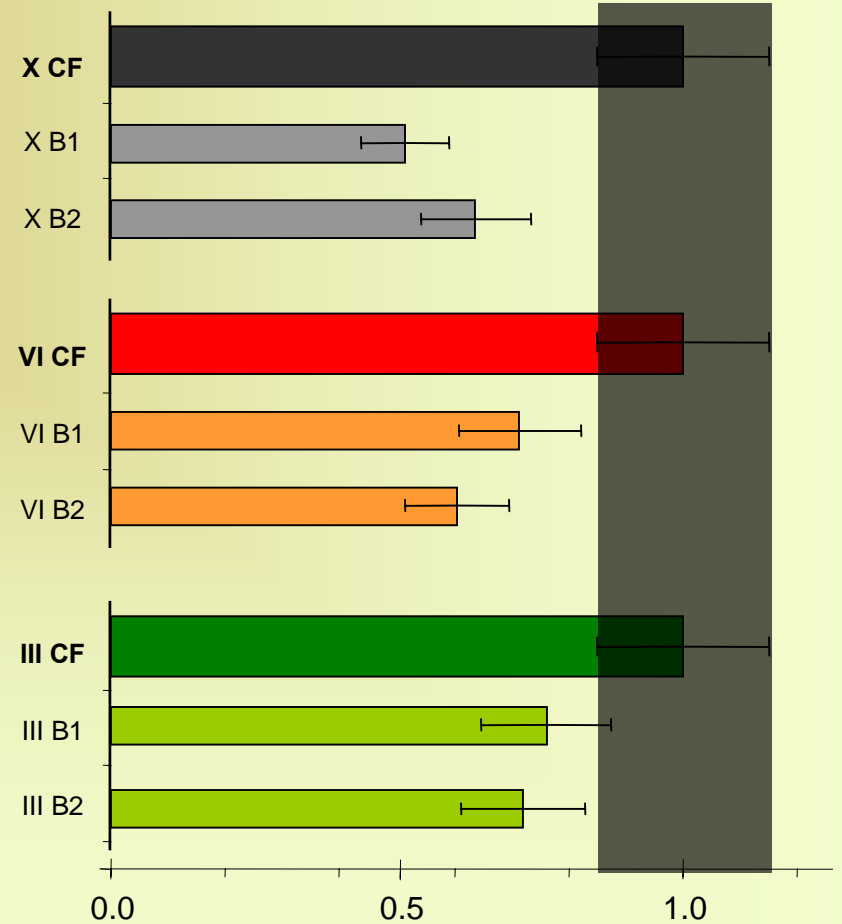
# Smoked Medium Toxicity

- CINT

**NRU**



**MTS**



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## ISO & CINT smoking regime

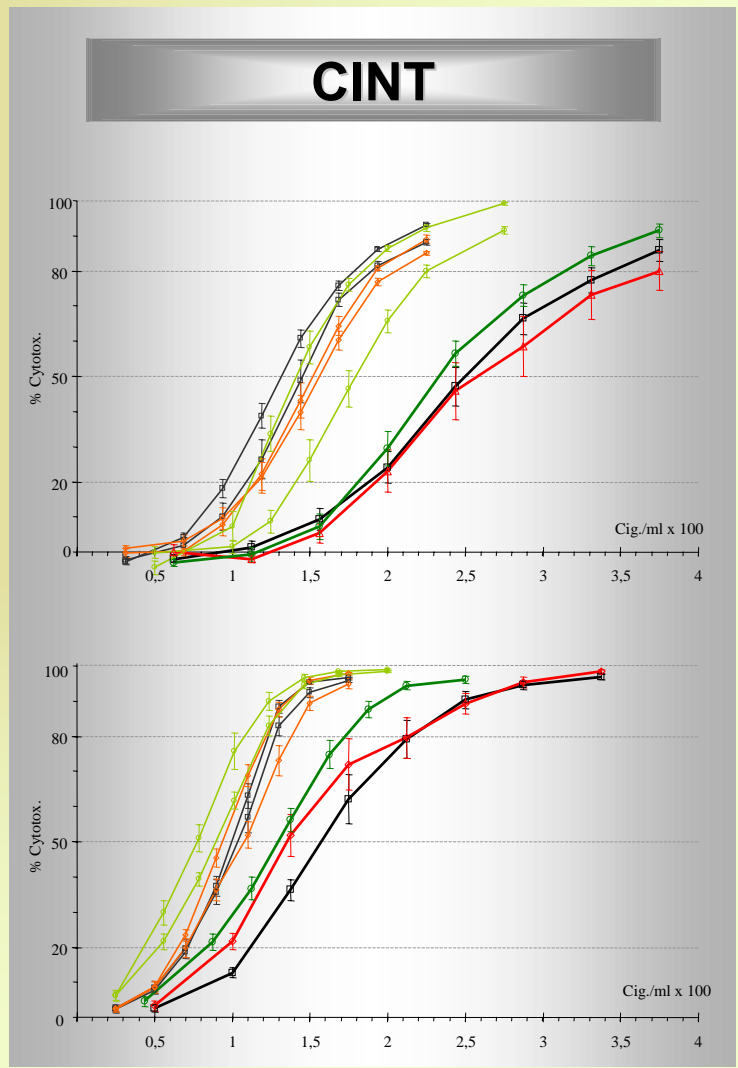
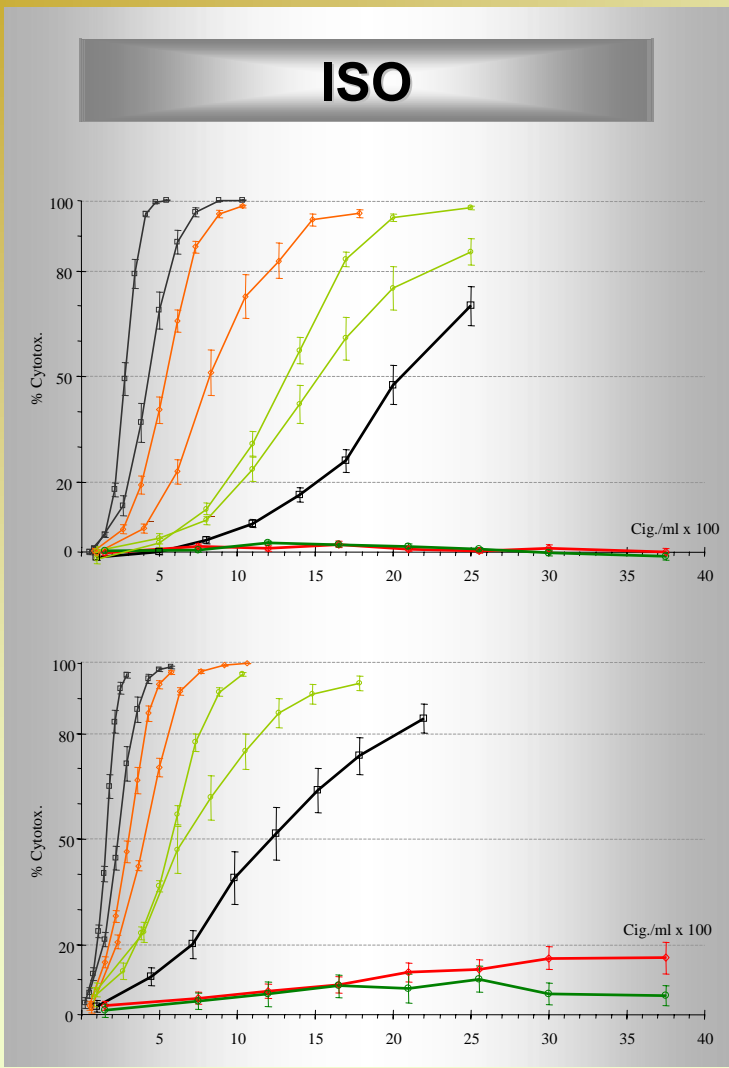
- Condensate toxicity
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  - fresh smoke
  - smoked medium (bubbled)
- **Toxicity of Vapour Phase bubbled medium**
- Contribution of VP to WS toxicity
- Effect of Charcoal on Whole Smoke toxicity

# Vapour Phase Toxicity - bubbled medium

**NRU**

- X CF
- X B1+2
- ◇— VI CF
- ◇— VI B1+2
- III CF
- III B1+2

**MTS**

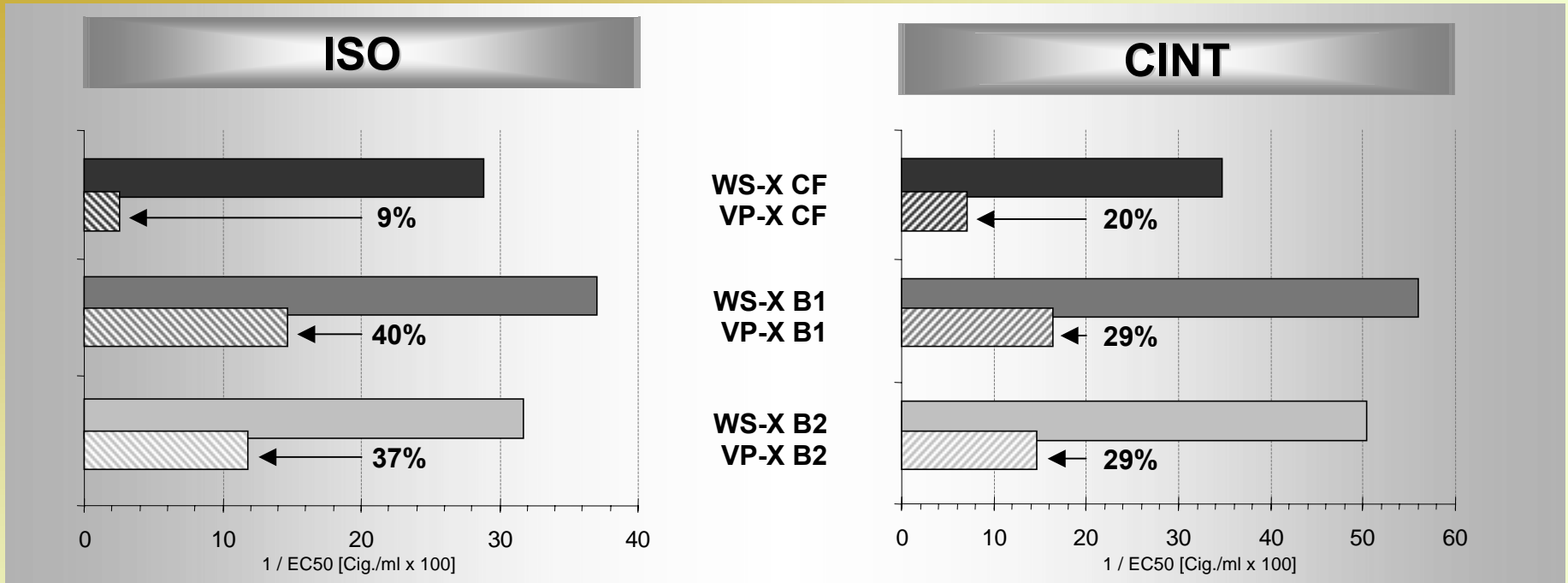


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## ISO & CINT smoking regime

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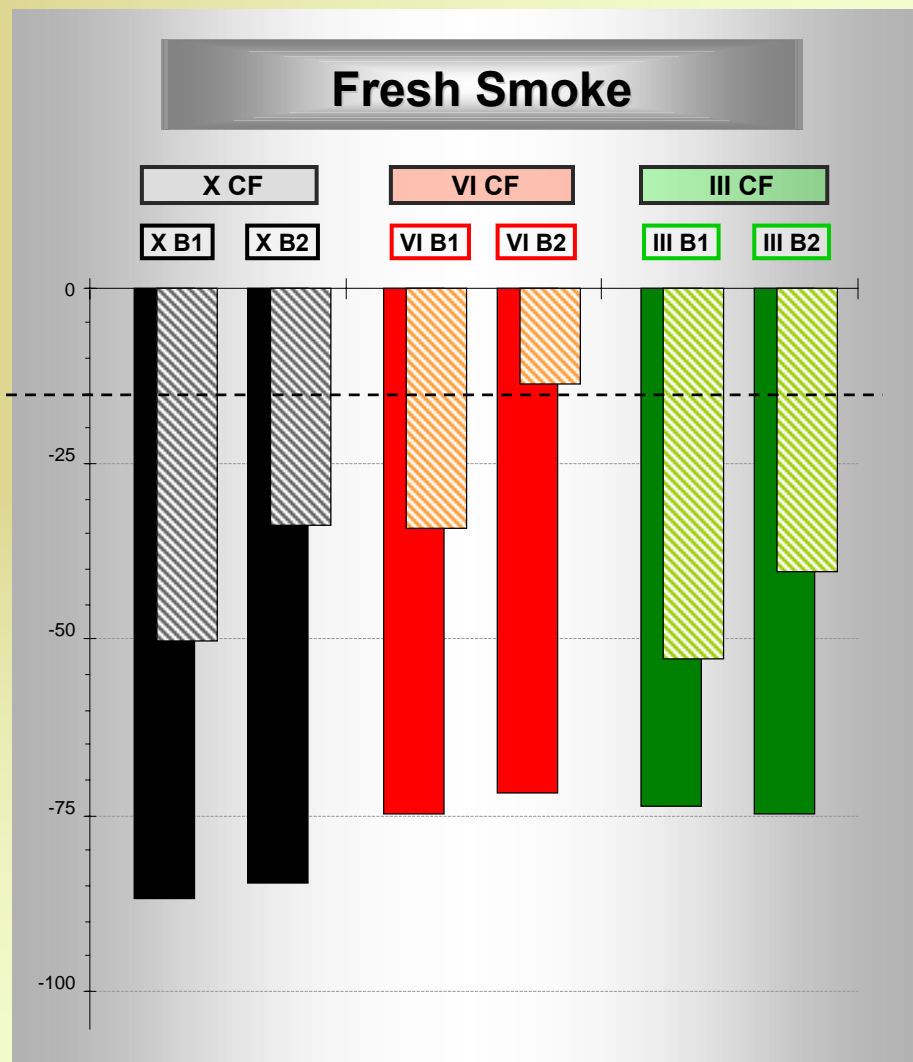
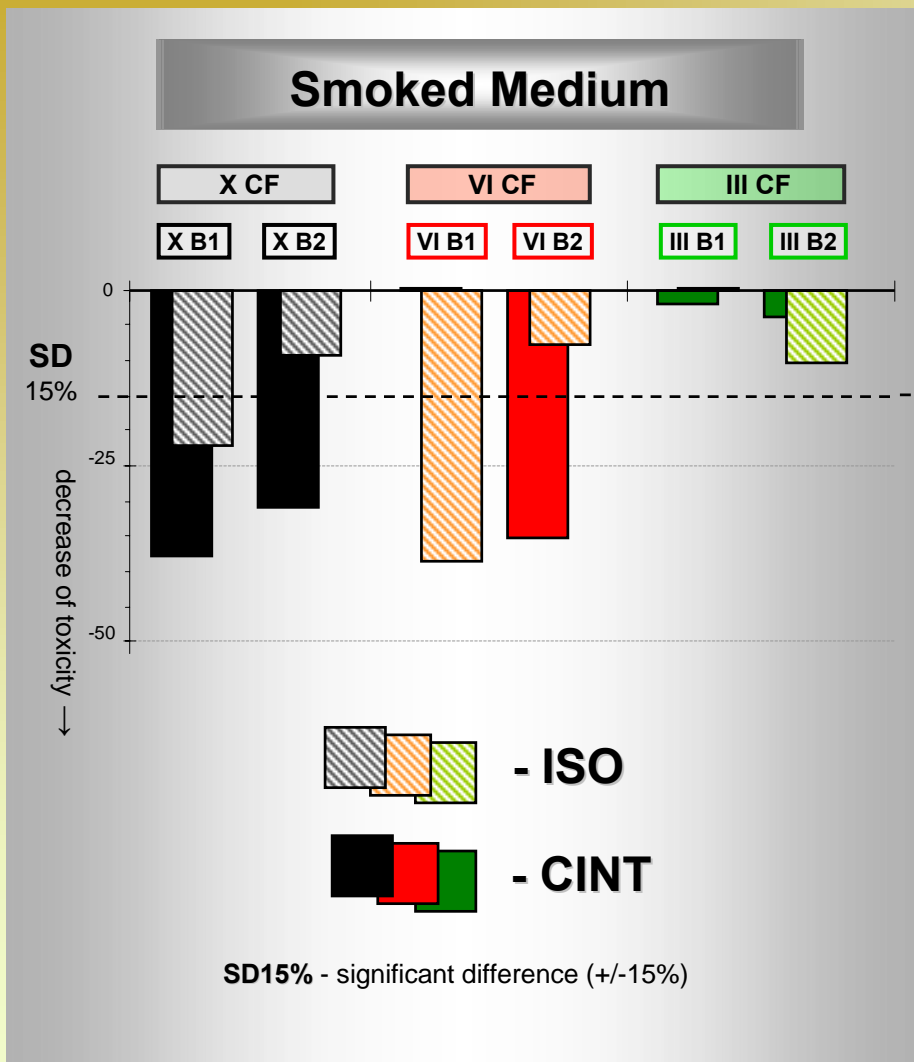
# Cigarette specific toxicity (NRU - 1/EC50) of Whole Smoke and Vapour Phase in Smoked Medium (10mg product)



%VP tox. in WS		X CF	X B1 / B2	VI CF	VI B1 / B2	III CF	III B1 / B2
NRU	ISO	9	40 / 37		43 / 44		53 / 47
	CINT	20	29 / 29	17	35 / 21	17	30 / 31



# Comparison of Whole Smoke toxicity (NRU) of bench mark cigarettes and charcoal filter cigarettes



# Conclusions

- In ISO and CINT smoking regime all three charcoal test cigarettes showed a significant decrease of Vapour Phase toxicity.
- The condensate toxicity of cigarettes smoked according to the ISO and CINT regime remained at roughly similar level.
- Whole Smoke toxicity test with bubbled medium confirm the positive effect of charcoal filter only in MTS test.
- The fresh Whole Smoke show significant lower toxicity for charcoal cigarettes. When smoking according to CINT whole smoke toxicity of test cigarettes was found to be 70% lower compared to benchmark products.
- The decrease of toxicity in fresh smoke seems to originate not only from the Vapour Phase. The fresh particulate matter of smoke seems to contribute positive effects.

# Thanks to



**Elke Burmester**

**Birgit Johnston**

**Edmond Kahl**

**Catrin Lietz**

