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Assessing isocyanate skin and surface contamination in car painters using SWYPE-RGB analysis

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BACKGROUND:
Isocyanate Occupational Asthma

- Isocyanate; the most frequently reported causative agents of allergic occupational asthma
- Affect 1 to 25% of the isocyanate-exposed population
- Asthma cases reported among car body painters
- Isocyanate can cause sensitization leading to asthma.

ISOCYANATE AND DERMAL EXPOSURE

- Respiratory sensitisation may be induced via skin exposure (Redlich 2010) as well as inhalation route
  - toxicological and epidemiological evidence (Bello *et al.* 2007)
  - dermal exposure to TDI can result in sensitisation of the respiratory tract in guinea pigs (Karol *et al.* 1981)
  - increase in urinary isocyanates in workers with skin contamination where airborne isocyanate levels were low. (Creely *et al.* 2006)

TAKE HOME PATHWAY

Workers may take home the sensitising agent from the workplace *via* contaminated skin and clothes, so exposing their family members to occupational sensitisers and the risk of developing asthma.

AIMS AND OBJECTIVES

- Identify suitable methods for dermal sampling and analysis of isocyanate
- Validate the selected method in characterizing isocyanate exposure

METHODS

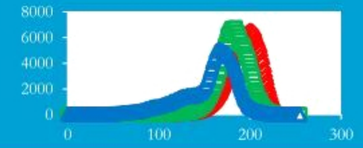
(Based on Ceballos *et al.* 2009 with modification)

Sampling method:
Skin and surface wiping using SWYPE™ pad (CLI Colormetric Laboratory Inc.)

Scan SWYPE™ using a photo scanner attached to a laptop computer

Scanned images were saved as raw TIFF files and analyzed using Image J (National Institute of Health, US) for Red-Green-Blue histogram

SWYPES™ RGB histogram:
Results represented as mean colour intensity values.



METHODS

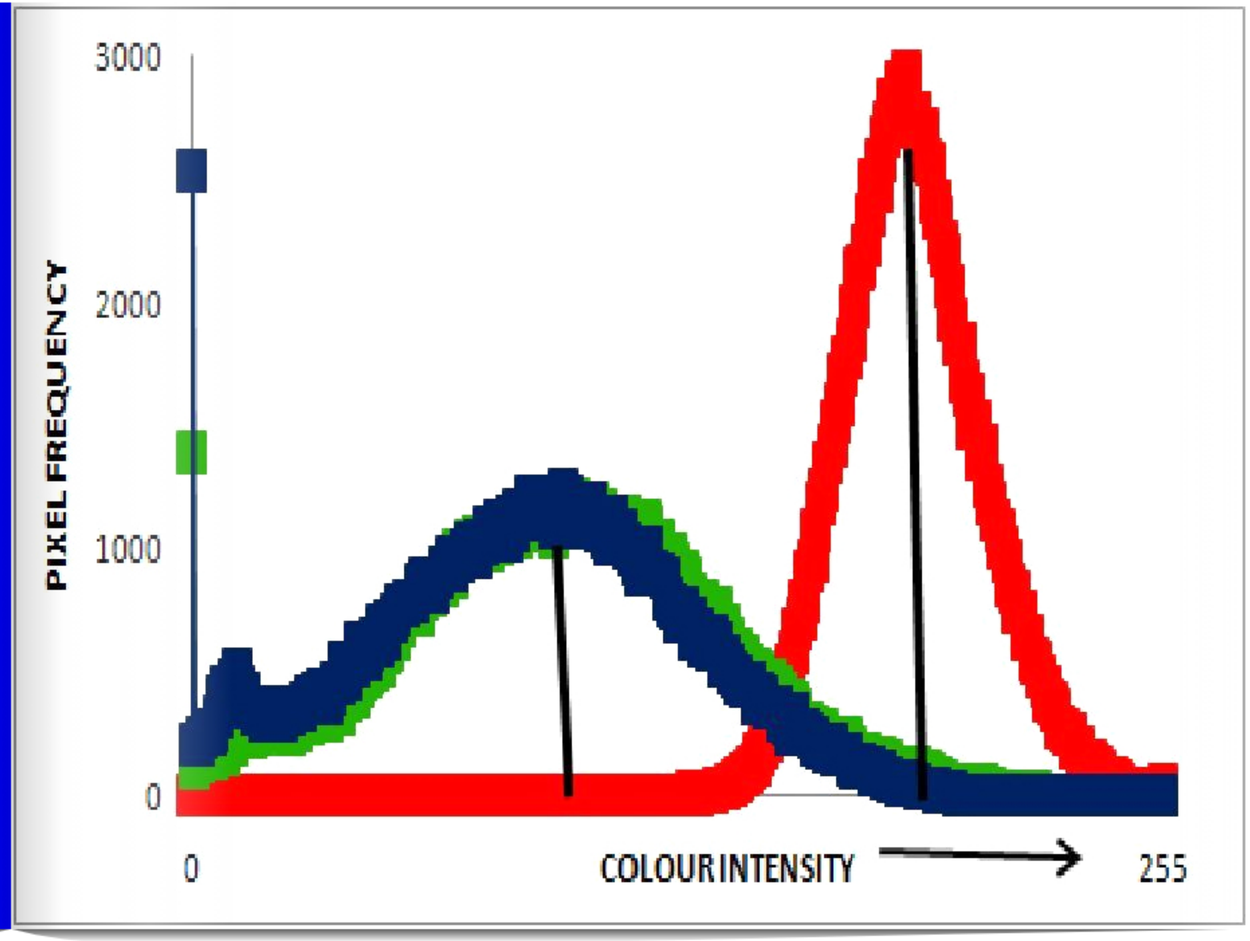
- The study involves three components:

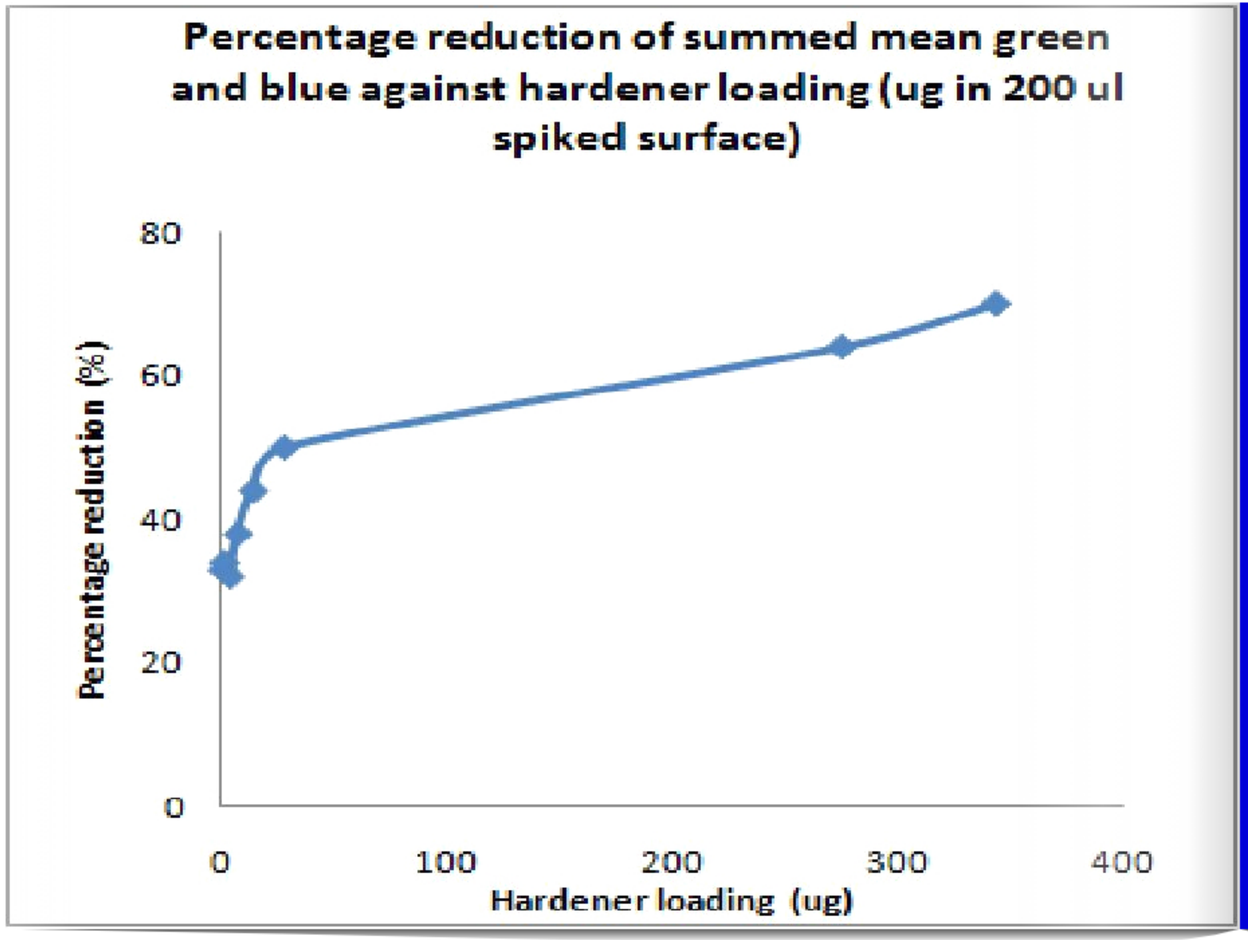
Method development (laboratory testing)

Validation of method (characterizing exposure)

Take home exposure determination

RESULTS FOR LABORATORY TESTING AND ISOCYANATE EXPOSURE CHARACTERIZATION IN THE WORKPLACE

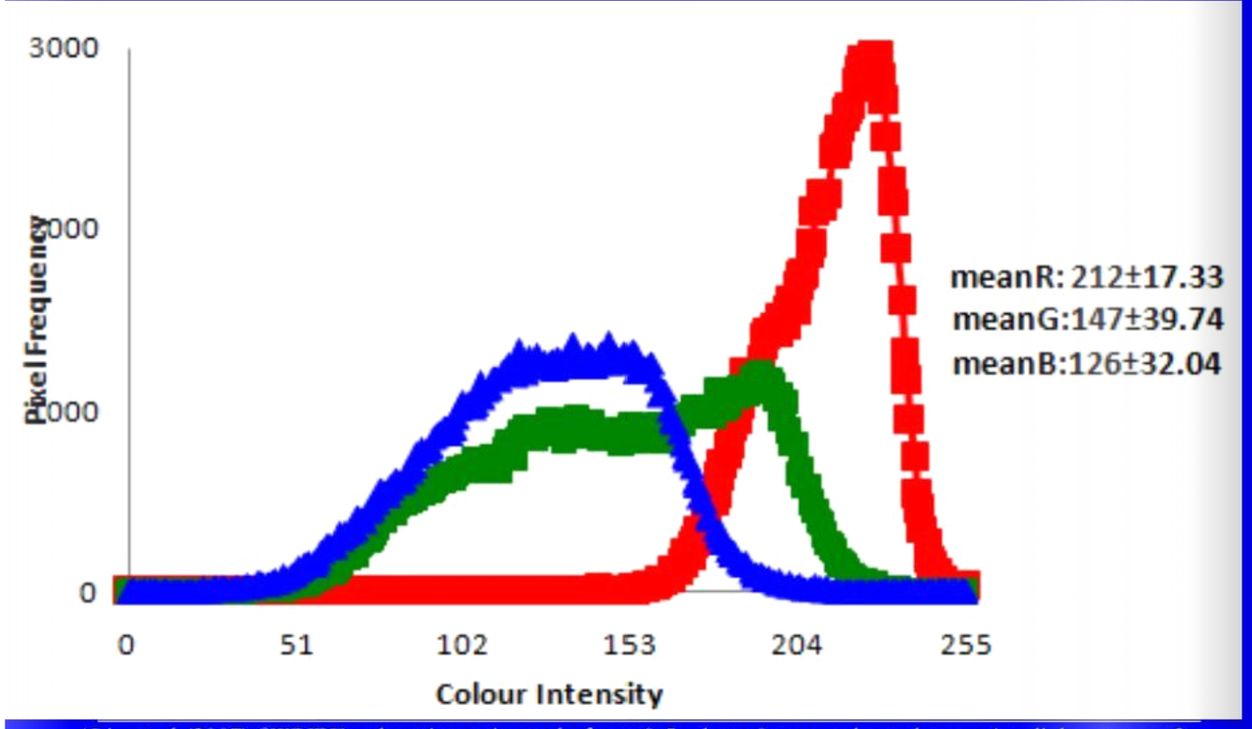




Percentage Recovery

	Percentage Recovery (%)	
	Summed Green and Blue	Average
Low Spiked NCO (6.88 ug)	75.8	
Medium Spiked NCO (34.4 ug)	79.4	70.6
High Spiked NCO (275 ug)	56.7	

Example results of characterization of isocyanate exposure at car body workshop



*Liu et al (2007) SWYPE colour intensity scale from 0-5 where 0= no colour change, 1 = light orange, 2 = orange, 3 = deep orange, 4 = red orange and 5 = deep red

RESULTS: TAKE HOME EXPOSURE

- Four car body workshops agreed to participate (40 approached within Aberdeenshire; <40 miles)
- N=12 (7 car sprayers, 2 panel beaters, 1 paint mixer, 1 manager and 1 finishing/untaping worker)

SWYPE skin and surface sampled	Positive results
Skin (n=12)	n=1 (finishing worker's)
Footwear (n=12)	n=2 (car sprayers')
Car body workshop exit door handle (n=4)	none
Car steering wheel (n=4)	none
House door handle (n=1)	none

DISCUSSION/CONCLUSION

- SWYPE technique was able to recover 70% of isocyanate loaded from hard surfaces.
- The methods (SWYPE) could be utilized in measuring the take home dermal contamination for the actual fieldwork.
- Interferences of RGB analysis: eg dirt and wet paint.

FURTHER WORKS

- To validate the SWYPE-RGB analysis with quantitative assay MDHS 25/3 (HSE 1999).
- To determine the take home contamination of isocyanate among car painters utilizing the technique.
- To make a conceptual model of transfer of take home contamination; eg
  - from sources of exposure to skin, surface to skin, skin to surface, skin to skin, surface to surface

ACKNOWLEDGEMENTS

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Thank you,
for your kind attention.

REFERENCES

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