How to research your new ingredient for concrete and publish your findings.

An example of a typical type of paper

Peter Claisse
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• The problem

• Elements of a Research Programme
  – Research objectives
  – Materials characterisation
  – Pre-treatment
  – The basic tests
  – Environmental and health impact
  – Site trials

• The Publication
  – Introduction
  – Experimental Methods
  – Results and Discussion
  – Conclusions

• Conclusions
The background that we all know

• Cement production gives off a lot of CO$_2$. Approximately 5% - 9% of the total.
• The secondary materials that can be used in cement can present disposal problems if not used (in the US they may call them “toxic”)
• Mineral extraction to make cement is also a problem. Aggregate extraction is a big problem.
• Poor countries cannot afford to build the homes they need.
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Research Objectives

• Define the Product that will be marketed and the application it will be marketed for.
  – A grey powder will be easier to sell than something that looks like a waste.
  – There is clearly a market for low strength cements for house foundations, road sub-bases, trench fill etc. CLSM or CLSM+
  – If the product will be blocks or paving slabs etc. this must be clearly defined at the outset.

• You must explain to your sponsors that they may get a negative result (note that these should be published)
Materials Characterisation

• Must be enough analysis to make the work repeatable in other labs.
• An analysis of the variability of the materials is essential.
Pre-Treatment of Materials

- Grinding, calcining etc. may help but the cost must be calculated.
- Can be useful for converting a “waste” into a “product” to keep the regulators happy.
- Remember to keep archive samples in sealed containers.
The Basic Tests

• Always start with strength.
• Durability tests must be targeted at the chosen applications for the product.
Environmental and Health Impact

• Is your work any use without these tests?
• Leaching tests are essential on all products. Even if they will be dry in use they will get wet after demolition.
• Will anybody cut or drill the product? Will the dust be toxic?
• Will the product be used in houses? Might there be trace gas emissions?
Why site trials are needed (1).

- To validate lab results on a large scale
- To demonstrate production methods
- To provide exposure tests for samples which are then returned to the lab
Why site trials are needed (2).

• To provide publicity
• To provide education
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Normal good practice, such as adequate reporting of results from control samples and error bars on graphs, is assumed and not discussed here.
The Introduction

• No need to say that replacing cement is a good idea.
• Discuss the availability of the chosen materials.
• Define the product and the applications.
Experimental Methods

• Discuss problems with your methods (e.g. the “rapid chloride permeability test”). If you don’t, your reviewers will.
Presentation of Results

• Do not try to present too much.
• Do your different tests rank your different mixes in the same order? Plotting one test against another will validate (or invalidate) your results.
• Make sure every graph communicates something useful.
The Discussion

• Compare your product with existing alternatives. Focus on durability.
• If your strength is lower, don’t say this isn’t a problem.
• If one of your materials is sewage sludge ash, discuss the problems with marketing your product.
Conclusions of the paper

• Is your chosen cement replacement ready for use in industry? Be honest.
• Conclusions are often best presented as brief bullet points.
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Conclusions – what a paper should have

• An informed discussion of the source of the material including the availability.
• A physical and chemical analysis of the material including estimates of the range of values which might occur in the supply.
• Test results for strength and leaching of the product.
• A report on a site trial.
• An unbiased discussion of the problems which may be expected before the product is brought to market.
• An analysis of the long term consequences of introducing the proposed technology.
Thank you

www.claisse.info