INTERVIEW

Find out what makes FMP tick in our interview with:
David Brown

Fluid Mixing Process (FMP) Consortium:

INDUSTRIALLY-DRIVEN R&D PROJECT RUNNING SINCE 1983.

David Brown has worked for BHR Group for 19 years, is a senior technical consultant and heads up our team of process engineers; providing technical consultancy and hands on roles for FMP. In this interview, we find out what makes this prestigious programme so important.

Why is FMP research so important? What are the real-world implications?

The key point about FMP research is that it is industrially relevant. We undertake research to obtain new knowledge about mixing processes that can make a real impact in the various process industries, such as Pharmaceuticals, PCP, Speciality Chemicals, Petrochemicals, Food; the common element in all of these process industries is mixing. There is so much cross-over between different industries I would estimate that they share over 80% of issues. Mixing affects much more than blending to make something uniform – it can have a critical effect on droplet sizes, solids or gas dispersion and mass transfer, or the success of a chemical reaction. It's more than just stirred tanks as well; we also work on in-line and jet mixing systems, and are currently running a project looking at blending by adding a gas – a technique that's been used to mix reactor kill solutions.

The biggest benefit of getting the mixing right is that it means people can get processes up and running faster because they can better predict how systems are going to perform. Also when there are problems it's easier to understand the cause and how to fix it. These sort of benefits go straight to the bottom line in terms of cost savings and efficiencies.

A critical aspect of the experimental work we do is that we perform our tests at reasonable and usually multiple scales, which is what makes the difference for industry. Lots of academic work can't be applied to real industrial processes as it can often be undertaken at small scale with less realistic mixing geometries. With FMP, we make sure the geometries we test are representative of the geometries found in our customer's real pilot and full scale plant.

There is, of course, a lot of good academic work being done internationally, and some of it is very useful. We keep abreast of this work, develop and apply it, showing how it works in the real world.

How does membership work?

All members get three core deliverables;

1. Access to all of the experimental data and analysis we've performed and support using it. This goes back over 35 years and a lot of the old work is still novel and unique;
2. Design guidelines and use of our Excel based mixer design and rating tool; and,
3. Eight days of confidential consultancy where we can look in more detail at some of their own specific process.

The eight days consultancy doesn't include general support or advice on any of the work, we are always there on the end of the phone or by e-mail to provide general support.

In addition to those main benefits, new members can also have us visit their chosen site and give their team a two day mixing course which is usually tailored to their specific needs or interests.

"Fluid mixing is at the heart of process operations."

Typically, we have two key contact people in each company, and they customarily attend the Steering Committee Meetings, though who represents each company at the meetings is completely flexible. There's meetings in the Spring and Autumn in the UK, and a meeting in Philadelphia in the Spring – hopefully after the snowy season is over. People can attend either on person or on-line and we do get members from the USA listening in to the UK meetings in their pyjamas due to the time difference!

A voting process is used to select experimental projects each year, ensuring all members can directly influence the work we perform and that the overall programme best supports the membership as a whole. We propose more work than we can physically undertake based on the Steering Committee input, which is then put to a vote. All the members get 24 votes each, and once the voting has taken place, we plan our work based on the work they are interested in. This pooled research budget provides a great return on investment as essentially you put in £40,000 per year and in return receive research to the value of £800,000. Feedback we've had from our members is that, even if the work only covers 70% of their first choice, it's still incredible value.

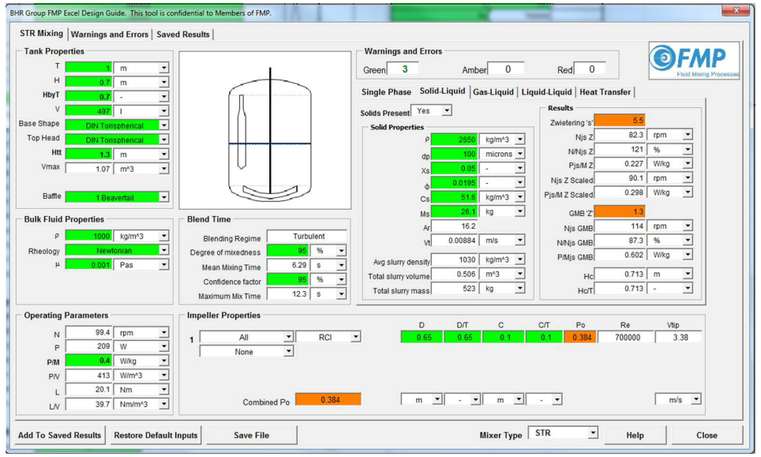
What sort of projects do you undertake?

The Design Guide is developed using information obtained from the experimental programme, as well as any useful new information available in the public domain – though often we have to test that to give us confidence in its application before including it.

The experimental programme focuses on mixing in tanks with impellers, in-line mixers and jet mixers. Work with rotor-stators, bead mills and other higher intensity mixers is performed in our DOMINO consortium, which runs alongside FMP.

Essentially there are two kinds of experimental project for FMP. Most of the work is designed to develop design and scaling rules, which are also critical in predicting the performance of existing systems, and the other is in generating additional data to allow members to apply these approaches to a wider range of systems. In the first case, we are developing and validating approaches to solving specific problems. Examples include the prediction of drop sizes in stirred vessels (a classic example of an issue of equal concern to people making hand-creams as well as emulsion polymers), or the number of static mixer elements required to avoid an additive passing through the mixer without being completely mixed.

The work on in-line systems is particularly important because there is so little useful design information available in the public domain, so it is very popular with members. An example of the second type of work is the extension of the scale-up rules we've developed to maintain yield and selectivity in chemical reactions - we've been collecting additional data with retreat curve impellers to make them easier to apply for members in the pharmaceutical industry. There is often a crossover between the two types of work, which makes the boundaries between the two types of project is a little blurred.



What is your favourite aspect of your research?

From a personal point of view, I've been particularly focused on solid/liquid processing and developing correlations to scale up and predict the distribution of solids in stirred tank reactors. It's important to me that I still get the time to go into the lab and collect data, and I do enjoy getting time to perform statistical analysis to develop predictive correlations. I've recently been completing work on the prediction of the solids cloud height in a stirred vessel (the absolute minimum conditions for a good distribution). This work is crucial because there was nothing in the public domain that has worked, and it is such an important phenomena for everything from distributing a catalyst, to ensuring the concentration remains uniform as you drain a tank (and you don't want to be left with solids on the base once the tank is empty).

Our findings are confidential and for FMP Members only, however I am talking about a sub-set of this work (not enough to give the correlation away, but enough to highlight the influence of some key variables, such as scale, which haven't been published anywhere) at Mixing XXVI – the next North American Mixing Form (NAMF) conference in June. Get to Puerto Rico if you can!

Another aspect of my work that I'm particularly proud of is the FMP Excel Design Guide, which I've put a lot of personal effort into. It's unique in the industry and provides great value to our FMP Members, which of course is the main objective. Using the design guide, it's really easy to recreate a model of the customer's pilot plant, and then very simply check the impact of changing operating conditions or transfer the process between scales. It's not a tool for complete novices, but with input from FMP engineers (and attendance at a mixing course or a reasonable bit of background), it's really easy to pick up and get using. Everyone has and knows how to use Excel, so the interface is really simple.

Can you give an example of how we've solved a problem for our members?

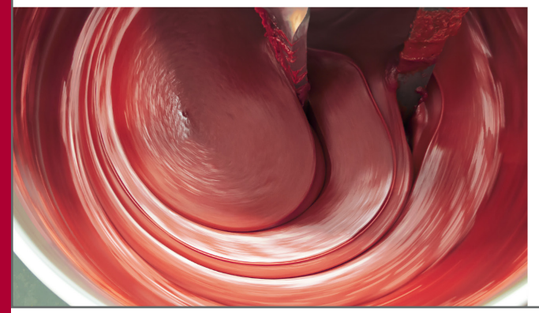
There are lots of different ways we help our clients. Often they want to run a process at a larger scale (or just in a new plant) and with more flexibility. We can review designs put forward by manufacturers, which of course don't usually match the current design, and comment on their likely success and how they could be improved. The benefits for the client are not just about cost saving, it's about confidence that their investment will work successfully and for a long time – it's great to have a bank of industry evidence to inform decisions. If a client has a new product that they need to produce whilst utilising as much existing plant as possible, we can help them assess the equipment available and make recommendations on what they need to do to ensure it works. There's also been a number of cases when we've helped guide member's pilot scale studies to make sure they are appropriate to use for scale-up.

Are FMP's methods generally accepted? Are they unusual or new?

People come to BHR's FMP team because of the custom tools and techniques along with the expertise in knowing which ones to use for specific applications. We usually use model systems rather than actual chemical process that would be used by members, and our tools and techniques allow us to apply these results to the real process with confidence.

There is a lot of skill in selecting the most appropriate simulant materials to best represent and recreate the performance of the real industrial system, often at smaller scale. That's particularly tricky where there's complex rheology, and we've been doing more and more work with complex rheology fluids in recent years – in in-line mixers as well as stirred vessels.

In some instances FMP has actually developed the experimental methods and approaches that are used industry wide. In 2005 I co-authored a chapter on "Experimental Methods" in the NAMF Handbook of Industrial Mixing, based on



"Applying academic knowledge to real world problems is what drives me."

Why did you become a process engineer and what drew you to this field?

I studied Chemical Engineering at University and really like fluid dynamics. I joined BHR in 1998 and developed my own skills through the company to my current position heading up our team of process engineers. BHR was an ideal fit for me. I love the combination of science and research in particular the application to real processes and problems. I find that really satisfying. I like interacting with academics and industry and FMP is an ideal link between pure academia and industry practice. We've got a great team involved in FMP, and working with them is a pleasure – even in the busy build-up to the Steering Committee Meetings.

What do you like to do when you're not working on FMP research?

I love spending time with my family and I enjoy cycling and running, and my main other hobby is photography. I used to do a lot of my own black and white film processing – and I do miss it in the modern digital age. A few years ago I had a good time using infrared film which takes a lot of patience and perseverance, but is a huge buzz when you develop a good shot. With a lot of our techniques in the lab, video as well as photography is becoming a more and more useful tool to provide both qualitative and quantitative information, so my hobby has a useful application to my work.

Find out more about FMP membership:

t: +44 (0) 1234 750 422

e: info@bhrgroup.com

www.bhrgroup.com