CLAIMS

1. A cell lysis system comprising:

a driver apparatus which incorporates:

a plurality of driver output terminals which provide an electrical connection between the driver apparatus and a cell lysis device to drive an ultrasonic transducer within the cell lysis device;

an AC driver which generates an AC drive signal at a predetermined frequency and outputs the AC drive signal at the driver output terminals to drive the ultrasonic transducer within the cell lysis device;

an active power monitoring arrangement which monitors the active power used by the ultrasonic transducer when the ultrasonic transducer is driven by the AC drive signal, wherein the active power monitoring arrangement provides a monitoring signal which is indicative of an active power used by the ultrasonic transducer;

a processor which controls the AC driver and receives the monitoring signal from the active power monitoring arrangement; and

a memory storing instructions which, when executed by the processor, cause the processor to:

A. control the AC driver to output an AC drive signal to the ultrasonic transducer at a predetermined sweep frequency;

B. calculate the active power being used by the ultrasonic transducer based on the monitoring signal;

C. control the AC driver to modulate the AC drive signal to maximise the active power being used by the ultrasonic transducer;

D. store a record in the memory of the maximum active power used by the ultrasonic transducer and the sweep frequency of the AC drive signal;

E. repeat steps A-D for a predetermined number of iterations with the sweep frequency incrementing with each

iteration such that, after the predetermined number of iterations has occurred, the sweep frequency has been incremented from a start sweep frequency to an end sweep frequency;

F. identify from the records stored in the memory an optimum frequency for the AC drive signal which is the sweep frequency of the AC drive signal at which a maximum active power is used by the ultrasonic transducer; and

G. control the AC driver to output an AC drive signal to the ultrasonic transducer at the optimum frequency.

2. The system of claim 1, wherein the active power monitoring arrangement comprises:

a current sensing arrangement which senses a drive current of the AC drive signal driving the ultrasonic transducer, wherein the active power monitoring arrangement provides a monitoring signal which is indicative of the sensed drive current.

3. The system of claim 1 or claim 2, wherein the memory stores instructions which, when executed by the processor, cause the processor to:

repeat steps A-D with the sweep frequency being incremented from a start sweep frequency of 2800kHz to an end sweep frequency of 3200kHz.

4. The system of any one of the preceding claims, wherein the memory stores instructions which, when executed by the processor, cause the processor to:

in step G, control the AC driver to output an AC drive signal to the ultrasonic transducer at frequency which is shifted by between 1-10% of the optimum frequency.

5. The system of any one of the preceding claims, wherein the AC driver modulates the AC drive signal by pulse width modulation to maximise the active power being used by the ultrasonic transducer.

6. The system of any one of the preceding claims, wherein the memory stores instructions which, when executed by the processor, cause the processor to:

control the AC driver to alternately output an AC drive signal to the ultrasonic transducer at the optimum frequency for a first predetermined length of time and to not output an AC drive signal to the ultrasonic transducer for a second predetermined length of time.

7. The system of claim 6, wherein the memory stores instructions which, when executed by the processor, cause the processor to:

alternately output the AC drive signal and to not output the AC drive signal according to an operating mode selected from:

Operating mode	First predetermined length of time (seconds)	Second predetermined length of time (seconds)
1	4	2
2	3	2
3	2	2
4	1	2
5	1	1
6	2	1
7	3	1
8	4	1
9	4	3
10	3	3
11	2	3
12	1	3

8. The system of any one of the preceding claims, wherein the system further comprises:

a cell lysis device which is releasably attached to the driver apparatus, the cell lysis device comprising:

a housing;

a plurality of electrical terminals which are connected electrically to the plurality of driver output terminals;

a sonication chamber provided within the housing, the sonication chamber being at least partly filled with an ultrasonic wave transfer medium, wherein the housing comprises an opening which is configured to receive a sample container such that a part of the sample container projects into the ultrasonic wave transfer medium;

an ultrasonic transducer which generates ultrasonic waves in the ultrasonic wave transfer medium within the sonication chamber, wherein the ultrasonic waves are transferred by the ultrasonic wave transfer medium from the ultrasonic transducer to the sample container to lyse cells when cells are contained within the sample container.

9. The system of claim 8, wherein the driver apparatus comprises a first interference fit attachment and the cell lysis device comprises a second interference fit attachment, and wherein the first interference fit attachment releasably attaches to the second interference fit attachment to releasably attach the cell lysis device to the driver apparatus.

10. A method of lysing cells in a sample, the method comprising:

placing a liquid sample containing cells to be lysed in a sample container;

positioning the sample container through an opening in a housing of a cell lysis device such that a part of the sample container projects into an ultrasonic wave transfer medium provided in a sonication chamber within the housing; and

attaching the cell lysis device to a driver apparatus, the driver apparatus incorporating:

an AC driver which generates an AC drive signal at a predetermined frequency and outputs the AC drive signal at a plurality of driver output terminals to drive an ultrasonic transducer within the cell lysis device;

an active power monitoring arrangement which monitors the active power used by the ultrasonic transducer when the ultrasonic transducer is driven by the AC drive signal, wherein the active power monitoring arrangement provides a monitoring signal which is indicative of an active power used by the ultrasonic transducer,

wherein the method further comprises:

A. controlling, by a processor, the AC driver to output an AC drive signal to the ultrasonic transducer at a predetermined sweep frequency;

B. calculating, by the processor, the active power being used by the ultrasonic transducer based on the monitoring signal;

C. controlling, by the processor, the AC driver to modulate the AC drive signal to maximise the active power being used by the ultrasonic transducer;

D. storing a record in a memory of the maximum active power used by the ultrasonic transducer and the sweep frequency of the AC drive signal;

E. repeating steps A-D for a predetermined number of iterations with the sweep frequency incrementing with each iteration such that, after the predetermined number of iterations has occurred, the sweep frequency has been incremented from a start sweep frequency to an end sweep frequency;

F. identifying, by the processor, from the records stored in the memory an optimum frequency for the AC drive signal which is the sweep frequency of the AC drive signal at which a maximum active power is used by the ultrasonic transducer; and

G. controlling, by the processor, the AC driver to output an AC drive signal to the ultrasonic transducer at the optimum frequency.

11. The method of claim 10, wherein the method further comprises:

repeating steps A-D with the sweep frequency being incremented from a start sweep frequency of 2800kHz to an end sweep frequency of 3200kHz.

12. The method of claim 10 or claim 11, wherein the method further comprises:

controlling, by the processor, the AC driver to alternately output an AC drive signal to the ultrasonic transducer at the optimum frequency for a first predetermined length of time and to not output an AC drive signal to the ultrasonic transducer for a second predetermined length of time.